Wilson Ornithological Club
MAR 31 '54

THE CONDOR

Volume 56 March-April, 1954 Number 2

JOURNAL OF THE COOPER ORNITHOLOGICAL SOCIETY

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JOURNAL OF THE COOPER ORNITHOLOGICAL SOCIETY

Published bi-monthly at Berkeley, California. Entered as second-class matter at the post office at Berkeley, California, May 15, 1925, under Act of Congress of March 3, 1879. Issued from the office of THE CONDOR, Museum of Vertebrate Zoology, Berkeley 4, California.

SUBSCRIPTION RATES

Subscription price to non-members, five dollars per volume, payable in advance. Single copies, one dollar each.

MEMBERSHIP DUES

Active members, four dollars per year in the United States, of which $3.00 is for a year's subscription to The Condor; four dollars and twenty-five cents per year in all other countries in the International Postal Union.

Sustaining members, five dollars per year.

The life membership fee is one hundred dollars. No additional dues are required. The money is invested and the interest only is used for Society publications. Life members receive THE CONDOR without additional charge.

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Send orders for back numbers of THE CONDOR and the PACIFIC COAST AVIFAUNA series to THOMAS R. HOWELL.

MANUSCRIPTS

Send manuscripts for publication to the Editor, ALDEN H. MILLER, Museum of Vertebrate Zoology, Berkeley 4, California, or to the Associate Editor, FRANK A. PITELKA, same address. Refer to suggestions on preparation of manuscripts for THE CONDOR on the back cover of recent issues of the journal.

Issued March 26, 1954

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THE CONDOR

VOLUME 56 MARCH-APRIL, 1954 NUMBER 2

A SYSTEMATIC REVIEW OF THE BOOMING NIGHTHAWKS OF WESTERN NORTH AMERICA

By ROBERT K. SELANDER

The foundation work bearing on the systematics of the nighthawks of the genus *Chordeiles* is that of Oberholser (1914). At the time of that author's revision, specimens of the Booming Nighthawk (*Chordeiles minor*) were not sufficiently numerous to permit a thorough study of geographic variation, especially as regards the intergradation of the western races. From Idaho, Utah, and Nevada only a few specimens from scattered localities were available. As material from western North America has gradually accumulated, considerable confusion has arisen regarding the geographic distribution, characters, and variation of some of the races. This has resulted in the not infrequent allocation of breeding birds from a single locality to two or more different subspecies.

Recently, Hawkins (1948) described birds from the Snake River region of southern Idaho and the Warner Valley, southeastern Oregon, as a new race, *twomeyi,* and suggested that birds from northwestern Utah and southeastern Washington might also be referable to that form.

The present work began as a study of the nighthawks of northern Utah. In the summer of 1950, collections were made in northern Utah and southern Idaho. Study of the relationships of these birds necessarily involved examination of specimens from all the western states, western Canada, and northern México. As a result, additional information concerning all the western races has come to light which permits a more precise analysis of variational trends. A survey of molts and plumages revealed characters distinguishing first-year individuals from adults.

I am indebted to the following persons for the loan and use of specimens: Miguel Alvarez del Toro, Museo Zoologico, Chiapas, México; Alfred M. Bailey, Denver Museum of Natural History; Herbert Friedmann, United States National Museum; C. Lynn Hayward, Brigham Young University; Frank A. Pitelka, Museum of Vertebrate Zoology; W. E. Clyde Todd, Carnegie Museum; and Robert T. Orr, California Academy of Sciences. Acknowledgment is made to Harold G. Higgins for permission to incorporate some of the data from his unpublished study "The Nighthawks of Utah" (1948) in the present report, and to Alden H. Miller for critical reading of the manuscript. V. G. Duran took the photographs of specimens.

Field work and preliminary study were accomplished in 1950 with the support of a Graduate Research Fellowship from the University of Utah Research Fund, and the work was completed at the Museum of Vertebrate Zoology in 1953, during which time the author held a Willard D. Thompson Memorial Fellowship and a National Science Foundation Fellowship.

TYPES OF VARIATION

The complex variation of this species has been described in detail by Oberholser (1914), but it is necessary to review and clarify certain points, especially as regards molts and plumages.

Sexual differentiation.—Characters distinguishing the adult female from the adult male include: (1) smaller size; (2) smaller size and mottled appearance of the white wing patch; (3) almost invariable absence of a conspicuous white subterminal tail bar; (4) pigmentation of the throat crescent; (5) browner, buffier, or more ochraceous under parts, especially posteriorly; (6) wider ventral dark bars; and (7) coarser dorsal mottlings in all western races, although in *howelli* they frequently are more vermiculiform.

As regards characters 5 to 7, degree of sexual differentiation varies from one racial population to another. Thus in *henryi, minor,* and *hesperis,* the sexes resemble one another more closely than in *sennetti* and *howelli.* In *henryi* and *minor* specimens of the

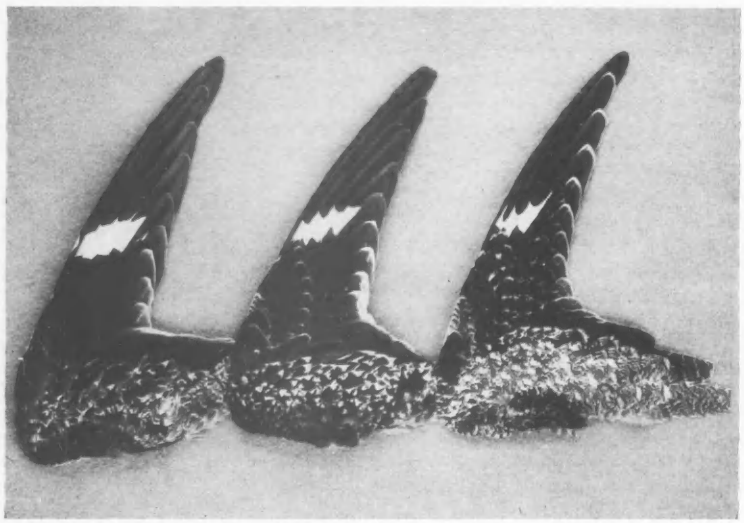

Fig. 1. Age differences in the wings of males of *Chordeiles minor.* Left to right: adult; first-year, showing retained juvenal primaries, secondaries, alula, marginal coverts of the manus, greater primary coverts, and distal greater secondary coverts; juvenile. Specimens are *C. m. hesperis.*

two sexes are, in fact, often difficult to distinguish on the basis of these characters alone, without reference to the presence or absence of a white subterminal tail bar and a well defined white throat patch. *Howelli* shows the extreme in sexual differentiation.

Molts and plumages and age differentiation.—It is not adequately known to what extent the downy young show individual and geographic variation, but racial color differences become apparent as the feathers of the juvenal plumage begin to replace the natal down.

In the juvenal plumage both sexes are similar in appearance and are much lighter dorsally than the adults by reason of a paler ground color of their feathers, a greater abundance of fine vermiculations, and a terminal splotch of solid color on the body feathers and wing coverts, which ranges, in the different races, from white to dark tawny. The ventral dark bars are more numerous, narrower, paler, and more extensive anteriorly, and the dark areas of the breast are paler. The light throat patch is poorly defined in both sexes, being barred and mottled, but it is usually slightly better developed in the

male. The conspicuous white subterminal tail bar, which is characteristic of the adult male, is lacking in the juvenile, and the wing patch is smaller and less uniform in width than that of the adult (fig. 1). The juvenal male of a given race has the wing patch about the size of that of the adult female of that race, whereas that of the juvenal female is still smaller. The juvenal remiges, greater primary coverts, and, to a lesser degree, the rectrices are broadly and abruptly edged terminally with white or buff, and the proximal 4 or 5 primaries are marked with mottled light bands (fig. 1). Juvenal contour feathers differ in structure from those of the adult in being laxer and in having a less substantial rhachis. Juvenal primaries are narrower than those of the adult.

In Utah and southern Idaho the juveniles generally first appear in the feeding flocks in the early part of August (Higgins, 1948:9) and usually they have completed growth of their juvenal plumage by the end of the month.

The juvenal plumage is retained only a short time, being succeeded by what Oberholser (1914:27-28) has termed the first-autumn plumage through a molt of the contour feathers. This molt occurs in September, when migration is getting under way (see page 67). The majority of the September juveniles examined are in various stages of transition between juvenal and first-autumn plumage. On the dorsum, the highly vermiculated juvenal feathers are replaced by feathers similar to those of the adult plumage, from which they differ in being duller and slightly laxer. Replacement at this molt involves most, if not all, of the contour feathers, including the marginal coverts of the wing, but the greater, middle, and lesser upper wing coverts are retained at least through September and until the birds have departed from North America. In the accounts of the races which follow, birds in juvenal or first-autumn plumage are referred to as "immatures."

When the immatures are in the later stages of attaining the first-autumn plumage, they are similar in appearance to the adult females but they have more numerous pale, dorsal mottlings, the anterior under parts are more abundantly mottled with gray or dull buff, and the throat patch is less well defined. They also are smaller than the adults as regards length of wing and tail.

In the first-autumn plumage sexual differentiation is more evident than in the juvenal plumage in that the female has the throat patch noticeably more heavily mottled than in the male. The lightish-edged juvenal primaries, secondaries, and rectrices serve to distinguish these birds from adults.

With reference to the sequence of molts and plumages of adult birds, that is, those a year or more of age, my findings are at variance with those of Oberholser (1914:28) and Gross (1940:221-224). According to Oberholser "the adult birds after the breeding season molt usually the contour feathers, but not the wing quills and rectrices, this taking place between the middle of July and the middle of September, mostly between July 15 and August 15." This statement requires some revision, at least as it applies to the western races.

One hundred July birds from various parts of the western United States were examined for molt, the vast majority of which show no evidence of molt other than that attributable to replacement following adventitious loss of feathers. Several specimens taken in southern Idaho on July 31 show partial replacement of the flanks and/or small patches of ensheathed feathers on the breast. Of 51 August specimens examined, only 14 show replacement on a scale at all indicative of a definite molt. These birds have small patches of ensheathed feathers or single, scattered new feathers on the breast, belly, head, nape, and scapular region. Usually molt is first evident on the abdomen or upper breast, but some birds replace several of the scapulars before molt begins in any other areas. The intensity of molt is comparatively weak, with only a few feathers molt-

ing at a time. No August specimen examined shows more than partial replacement of the body feathers. Most of the molting individuals were collected after August 15; an exception is a male (*henryi*) from Chihuahua, México, collected on August 1, which had molted most of the feathers of the under parts, nape, and scapular region. September birds show little advancement over August specimens. The most advanced bird, a female (*hesperis*) taken in Custer County, Idaho, on September 7, had replaced the scapulars and most of the feathers of the nape, breast, and belly. Another female from the same locality, taken on September 1, had some new scapular and crown feathers, and two other September birds were not molting. A migrant female (*hesperis*) collected on October 2 in Sonora, México, is in worn plumage and shows no signs of molt.

It is clear, then, that in the western races there is no regular occurrence of an extensive postnuptial molt prior to migration. Many, perhaps the majority, of the birds apparently perform migration in worn breeding plumage. Those individuals beginning molt before migration may be birds which, for one reason or another, are not occupied with nesting activities during late July and August.

I have not examined birds taken on their wintering grounds and so have been unable to trace through the molt, or molts, which occur during the winter months. According to Oberholser (1914:28), both immatures and adults undergo a complete molt in January or February, after which they are similar in appearance, but Gross (1940:224) stated that he was unable to determine the time of this molt. The relatively unworn condition of most of the feathers of birds returning to their breeding grounds in May or June indicates that there is a molt shortly before spring migration, possibly later than January or February. April specimens occasionally show a few growing feathers on the nape or breast, but whether this represents the concluding stage of the molt at which the flight feathers are replaced, as seems likely, or a separate molt was not determined. In any event, by May the immatures of the preceding fall have replaced the contour feathers and rectrices of the first-autumn plumage with feathers which are indistinguishable from those of the adult. A fact which appears to have been overlooked by Oberholser and Gross is that many of the first-year birds retain the juvenal primaries, secondaries, alulae, and a number of the upper wing coverts. Although abrasion at the tips of the primaries, alulae, and greater primary coverts tends to obliterate the abrupt light terminal edging characteristic of juvenal feathers, this edging usually persists on the inner two or three primaries and on the secondaries. The worn and faded condition of these feathers, the presence of indistinct light bands on the proximal four or five primaries, the small size of the wing patch, and the shortness of the wing provide additional characters by which first-year birds may be recognized (fig. 1). As a rule all the greater primary coverts and at least several of the greater secondary coverts are retained, and occasionally some of the middle secondary coverts are not replaced. The wing of the first-year male in figure 1 shows the common condition of partial replacement of the juvenal greater secondary coverts. Apparently no further replacement takes place after the birds arrive on the nesting grounds.

In addition to those birds which retain all the juvenal remiges, other first-year individuals may be recognized by the possession of one or more juvenal secondaries and secondary coverts in an otherwise adult wing. Of 135 May and June specimens having adult primaries, 57 show one or more juvenal secondaries. Apparently some immature birds begin replacement of the secondaries at the molt preceding spring migration but fail to complete replacement of the wing. Juvenal secondaries are recognizable by their faded and worn appearance in contrast to the relatively fresh condition of the newly grown feathers. The number of juvenal secondaries retained varies from all (13) to one, the usual condition being the retention of the central 2 or 3, with replacement on either

side. The greater secondary coverts may or may not be replaced. Occasionally replacement of secondaries is asymmetrical in the two wings. Only one definite case of partial replacement of the primaries was noted. This bird, a male *chapmani* from Cameron, Georgia, May 27, had replaced the two innermost primaries of the right wing and the single innermost primary of the left. Four of the central secondaries in either wing are juvenal while the remaining secondaries are fresh and adult in appearance. The alulae and some of the greater secondary coverts are juvenal. The relative scarcity of birds of this type suggests that once replacement of the primaries is initiated it is usually carried to completion.

The distinction between juvenal and adult secondaries becomes less obvious as the season progresses and the effects of wear increase, so that separation of adult and first-year July and August birds on this basis becomes increasingly difficult.

As regards the group of birds returning to the breeding range with a full complement of new remiges, and which probably is composed of both fully adult and first-year individuals, further age segregation was not attempted. If a first-year bird retained certain of the juvenal wing coverts, its age could be determined, even though the primaries and secondaries had been replaced, provided that fully adult birds replace all of the coverts of their preceding breeding plumage. However, it seems that the molt which occurs prior to spring migration rarely involves replacement of all the wing coverts *even* in fully adult birds. With the exception of an occasional specimen having all fresh coverts, the spring birds with all new remiges have either some of the marginals, greater, middle, or lesser secondary coverts conspicuously worn and faded (and, hence, apparently older) as compared to the relatively unworn condition of the other coverts and other parts of the plumage. In some cases coverts of three apparent ages are present. In most specimens about half of the proximal marginals of the manus are fresh while the distal ones are faded and worn. The number of old coverts in the wing varies individually from two or three to a condition in which half of the coverts are of this type. When few in number, they are most frequently clustered at the bend of the wing. They tend to occur in rows but are frequently scattered, apparently at random, throughout the rows of otherwise fresh feathers. In many instances new and old feathers alternate irregularly or a single worn feather occurs in a row of fresh ones. The highest incidence of old feathers is among the median secondary coverts. No evidence was found to suggest that these old coverts are replaced after the birds return to their breeding grounds.

In some birds having mixed coverts, especially those having a large proportion of worn ones, the older feathers show a degree of wear comparable to that shown by the retained juvenal coverts of birds known to be first-year by reason of possession of juvenal primaries and secondaries. This similarity would suggest that they are, in fact, juvenal feathers retained when the juvenal primaries and secondaries were molted. However, in other birds the older coverts are much more worn and faded than those of known first-year birds, suggesting that they represent retained coverts of the preceding breeding plumage. As noted earlier, some birds have three classes of coverts: the majority relatively unworn, a small number moderately worn, and a very few extremely worn.

Comparison of molts and plumages of C. minor and C. acutipennis.—In working out the sequence of plumages in *C. minor*, I also surveyed the plumages of *C. acutipennis*, using 180 specimens in the Museum of Vertebrate Zoology. This material consists in large part of specimens of *C. a. texensis* collected in the breeding season in California and specimens of that race from México (mainly Guerrero) taken in winter and in April. The collection also includes a few specimens of *inferior* from Lower California and *micromeris* from El Salvador. In general my findings confirm those of Oberholser (1914:87-88).

Although *C. minor* and *C. acutipennis* seemingly are quite closely related, they show certain important differences in molts and plumages. A basic difference is that in *C. acutipennis* the juvenal tail feathers show sexual dimorphism as regards the presence or absence of a subterminal tail band, which is in contrast to the condition in *C. minor* where juveniles of both sexes have the tail similar in appearance to that of the adult female.

At least in *C. a. texensis* the juvenal birds molt the contour feathers (including the lesser wing coverts), beginning usually in September. The new contour feathers are adult in appearance, so there is no distinctive first-autumn plumage. The majority of the immatures retain their juvenal remiges and rectrices through the subsequent winter and summer. As in *C. minor* the juvenal primaries, greater primary coverts, and secondaries are broadly and abruptly edged with gray, buff, or tawny and are recognizable throughout the year. It seems certain that some immature birds carry out a partial replacement of the remiges at the postjuvenal molt, since a number of spring-taken specimens with adult primaries show two or three (rarely more) worn juvenal secondaries and greater secondary coverts.

The adults of *C. acutipennis* have a complete postnuptial molt which for birds breeding in the southwestern United States usually begins in July (earliest, June 27). This molt is initiated with the loss of the first (proximalmost) primary. At about the time the seventh primary is being replaced, molt of the tail and secondaries begins with the loss of the two central rectrices and the distalmost secondary. The rectrices are then replaced in sequence toward the outside. The secondaries may show some irregularities in sequence of replacement. At about this same time molt of the scapulars and upper tail coverts begins.

In March and April the adult birds returning to the southwestern states are in relatively fresh plumage. There appears to be no prenuptial molt. There is no regular occurrence of old, retained coverts in spring birds having totally adult remiges, but a small proportion (about 5 per cent) of these birds have a few scattered worn coverts intermixed with fresh ones. It seems probable that such individuals are first-year birds which have replaced all of the remiges.

It is not unlikely that certain of the variations and peculiarities of plumage in *C. minor* arise from imperfections in adjustment of the molt pattern as a consequence of the delay of the "complete" molt until the wintering grounds are reached. In the more southernly distributed species, *C. acutipennis*, for which the length of the breeding season is less severely restricted by seasonal climatic changes and of which only the more northern populations are migratory, it is noteworthy that the pattern and sequence of molt is "normal" in that the complete postnuptial molt occurs immediately following the breeding season.

Individual variation.—Chordeiles minor exhibits an unusually wide range of individual variation in color and pattern of the plumage. In many local populations variants resembling several of the races occur with regularity as breeding birds. Juveniles appear to be considerably more variable than adults, but this variability results in some part from the circumstance that many of these birds are undergoing transition from juvenal to first-autumn plumage.

Unlike many caprimulgids, such as *Nyctidromus albicollis* and *Phalaenoptilus nuttallii*, adults of *C. minor* do not show pronounced color phases. In the juveniles of the races *minor* and *hesperis*, however, there is some tendency toward dichromatism in that two types occur: one (the more common) has mostly whitish dorsal mottlings and the other shows mostly dark buff or tawny markings.

Occasionally a variant is collected which has characters not encompassed within the

usual variational range of any of the subspecies. For example, I have seen several specimens of *hesperis,* including an adult male taken in July, 1950, 12 miles east of Oakley, Summit County, Utah, which show a general reduction in the intensity of the dark feather pigments coupled with a striking increase in the abundance of large whitish or ashy dorsal blotches and vermiculations. Birds of this "dilute" type bear a superficial resemblance to extreme examples of *sennetti* yet are easily separable from them.

Variation resulting from wear and fading.—By late July the wing and tail feathers have noticeably faded and show signs of abrasion. The ground color of the dorsum has faded and some of the lighter terminal portions of the contour feathers have worn away so that the bird has a less mottled and generally paler appearance than it had earlier in the year.

Over a period of years there is considerable post-mortem color change, with the light parts of the plumage tending to become dusky and the dark parts browner and paler. Buffy and tawny hues often become rufescent. As a consequence, the contrasts between dark and light areas of the plumage are reduced and the specimen assumes a more uniform appearance. Specimens not adequately degreased are especially prone to change color. Differences resulting from these changes are readily noticeable between specimens collected at the same locality 10 years apart (for example, southern Idaho, 1940 and 1950) and much of the material collected prior to 1920 has so foxed as to be of limited value for color comparisons.

GEOGRAPHICALLY VARIABLE CHARACTERS

Color and pattern.—Geographic variation has resulted in a number of populations of racial stature, examples of which are easily recognizable by their general aspect (fig. 2), but the highly variegated pattern of the plumage does not lend itself to detailed analysis of specific characters. The important variables of the dorsum are: (1) the intensity and, to a lesser degree, the hue of the dark background; that is, the median portion of the contour feathers and large areas of the flight feathers, which may be black to dark ochraceous brown; (2) the shape, size, and abundance of light mottlings and vermiculations, including those of the upper wing and tail coverts and streaks of the nape; (3) the hue and intensity of these markings, which vary from white through light buff to dark tawny; (4) the amount of silvery wash on the dorsal surface of the primaries and the terminal portions of the rectrices; and (5) the size of the white wing patch and tail bar.

Geographically variable features of the ventral surface include: (1) the intensity and, to a lesser degree, the hue of the dark bars of the belly and crissum, which vary with the dorsal ground color; (2) the width of these bars; (3) the extent, intensity, and hue of the dark areas of the breast, which also vary with the dorsal ground color; (4) the color of the mottlings of the breast, which is usually the same as that of the dorsal mottlings; (5) the general tone of the under parts, particularly the posterior region, resulting for the most part from a suffusion of pale color which is most evident in the light areas between the dark bars (the suffusion is more noticeable in the female than in the male and varies from gray-buff to pale tawny); and (6) in the female, the color of the throat patch, which is similar to that of the dorsal mottlings.

The color, form, and abundance of the light dorsal markings are the most useful characters for readily distinguishing examples of the various races (fig. 2). The progressive lightening of the dorsal aspect from *minor* through *hesperis, henryi, howelli,* and *sennetti* is achieved by a widening of the light and somewhat irregular bars of the contour feathers. As they widen, the light bars are interrupted by small, dark splotches

which produce a vermiculiform pattern. The light bars of the rectrices show a similar widening. The light areas of the contour feathers and coverts are mostly tawny in *henryi*, buffy in *howelli*, and white or pale buff in *hesperis* and *sennetti*. In the accounts of subspecies which follow, capitalized names of colors are those of Ridgway (1912).

Size.—Wing length (chord) and tail length (from the insertion of the two central rectrices to the tip of the longest rectrix) are the most satisfactory measurements for study.

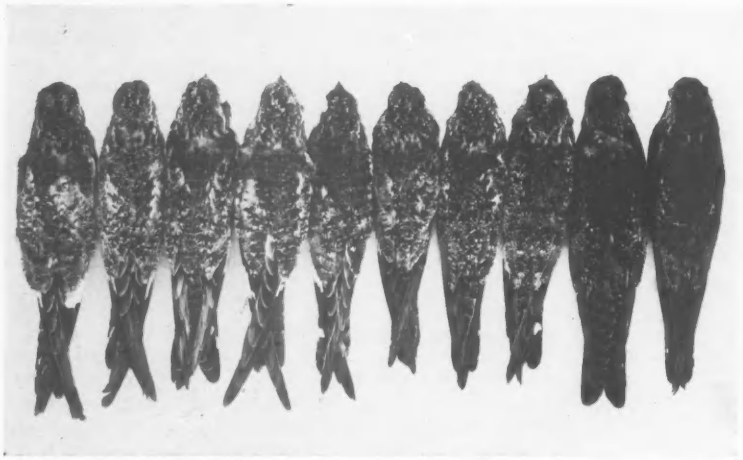

Fig. 2. Two adult males of each of the western North American races of *Chordeiles minor* shown in dorsal view. Left to right: *sennetti* (Colorado), *howelli* (Colorado), *henryi* (Colorado and México), *hesperis* (Idaho), and *minor* (British Columbia). Apparent size differences due largely to manner of preparation of skins.

For purposes of analyzing size variation the specimens were segregated into three groups as follows: (1) Juvenile; the tail is shorter than in any other group and the wing is shorter than in group 3. (2) Juvenal-winged first-year; there is, of course, no change in wing length over the juvenal plumage other than a slight decrease resulting from wear at the tip of the 10th primary; tail length is the same as in group 3. (3) Adult-winged first-year and adult; included in this group are (*a*) first-year birds which have replaced their juvenal primaries but which are recognizable by the retention of one or more juvenal secondaries and greater secondary coverts; wing length is intermediate between that of juveniles and true adults; also included are (*b*) true adults, that is, birds two or more years old, and, presumably, a number of first-year birds which have all adult remiges.

Because of difficulty in segregating mid-summer specimens with respect to subgroups 3*a* and 3*b*, the two necessarily were combined for measurement purposes. The wing length of breeding males, both adult and first-year, of *hesperis* from the northern Great Basin is presented in figure 3, where a marked bimodality of distribution is evident. Several of the smaller "adult" birds (wing 188 and 190 mm.) doubtless are first-year individuals which have replaced their juvenal primaries. The histogram of tail length of the same specimens shows an approximately normal distribution; it will be

recalled that immature nighthawks invariably molt their juvenal rectrices during the first winter.

In table 1 measurements of males of the various races are presented. Adult females average about 10 per cent smaller than adult males and juvenal-winged females are a like percentage smaller than juvenal-winged males. The data from adult males suggest

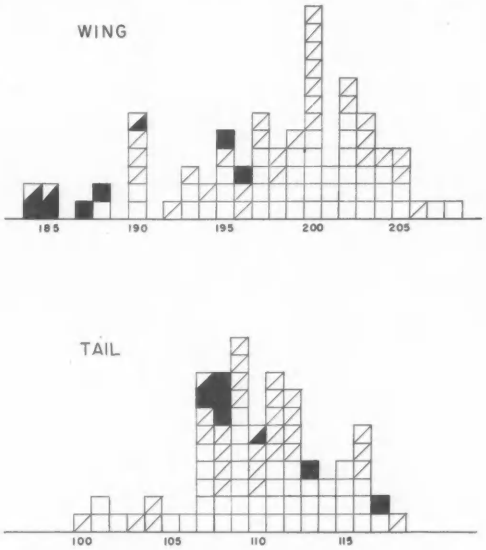

Fig. 3. Wing and tail length of male *Chordeiles m. hesperis* from southern Idaho (plain squares) and northern Utah (diagonally marked squares) in millimeters. Solid and half-solid squares represent first-year birds with juvenal primaries; open squares represent adult-winged birds.

some slight degree of north-south size differentiation in length of wing. Length of tail is more variable geographically, there being significant differences (at the level of non-overlap of two standard errors) between several of the sample means. In general this trend is for decreased size in eastern and southern races and increased size in western and northern populations.

MIGRATION AND SEGREGATION OF PROBABLE BREEDING INDIVIDUALS

It has not been generally recognized that spring migration of this species in the western states continues well into June and that fall migration often begins in the latter part of August. As a result, specimens taken in April, May, early June, and September frequently have been presumed to represent summer residents and have served as the basis for range allocations. At the outset of this study it became apparent that a careful screening of migrant birds from breeding birds would be necessary if a clear interpretation of geographic variation was to be achieved.

Spring migration.—Migrant Booming Nighthawks reach Brewster County, Texas, about May 20 (Van Tyne and Sutton, 1937:40). In Utah, according to Higgins (1948:

7-9), spring migration begins the last week of May and continues until "nearly the middle of June," with the peak of movement being reached by the end of the first week of June. His records over a seven-year period for first spring arrivals at Price, Carbon County, are between May 27 and June 2. Similar observations by C. W. Lockerbie (MS)

Table 1

Measurements in Millimeters of Males of *Chordeiles minor*

		Wing			Tail		
Locality	Age	No.	Mean Range	S.D.	No.	Mean Range	S.D.
minor							
Brit. Columbia,	ad.	11	199.9 (191–207)	4.9	11	111.8 (103–117)	3.9
N Wash.	1st yr.	4	195.0 (191–199)	....	4	110.7 (108–113)	....
hesperis							
S Idaho,	ad.	42	199.4 (188–208)	4.6	41	110.4 (102–117)	3.7
NW Utah	1st yr.	6	189.1 (184–196)	....	6	110.0 (107–116)	....
North-central	ad.	15	198.4 (190–205)	4.9	15	109.9 (100–116)	4.0
Utah	1st yr.	2	187.5 (185–190)	....	1	107	....
Central Utah	ad.	16	198.9 (192–206)	4.3	16	109.8 (103–118)	4.0
	1st yr.	1	184	....	1	110	....
Walden,	ad.	6	201.8(194–202)	....	6	110.1 (101–116)	....
Colorado	ad.	17	200.0 (195–206)	3.8	16	114.4 (109–120)	3.4
California	1st yr.	2	188.0 (186–190)	....	2	107.0 (105–109)	....
henryi							
Four Corners	ad.	19	196.0 (188–203)	4.1	20	109.1 (103–115)	2.9
region	1st yr.	6	183.0 (175–190)	....	6	107.0 (104–112)	....
S New Mexico,	ad.	6	202.1 (197–209)	....	6	111.8 (108–114)	....
S Arizona	1st yr.	4	188.0 (184–193)	....	3	105.7 (100–112)	....
Northern Mexico	ad.	1	191	....	1	105	....
	1st yr.	1	191	....	1	112	....
howelli							
Uinta Basin	ad.	12	197.6 (192–207)	4.1	12	109.4 (106–113)	2.2
	1st yr.	4	183.7 (184–196)	....	4	110.2 (107–114)	....
Eastern Colorado	ad.	14	197.4 (185–203)	4.1	13	109.3 (102–117)	4.3
	1st yr.	2	191.0 (191–191)	....	2	104.5 (104–105)	....
Weld County,	ad.	9	196.2 (189–204)	....	9	109.1 (104–116)	....
Colorado	1st yr.	1	182	....	1	105	....
sennetti							
NE Colorado,	ad.	4	199.0 (194–205)	....	4	107.0 (104–113)	....
E Wyoming	1st yr.	2	187.5 (183–192)	....	3	106.0 (104–108)	....
North Dakota,	ad.	17	196.1 (190–198)	4.1	18	107.2 (102–112)	3.3
Wisconsin	1st yr.	2	187.0 (185–189)	....	2	103.0 (101–105)	....
Saskatchewan	ad.	6	199.1 (195–206)	....	6	109.0 (106–114)	....

over a ten-year period at Salt Lake City are May 27 to June 8. Twomey (1942:401) recorded a migrant flock in the Uinta Basin, Utah, on May 14, 1937. In the Coeur d'Alene region of northern Idaho, Rust (1947:184) noted an average date of about June 6 for first arrivals over an eight-year period, with extremes of May 29 and June 18. Gullion (1951:140) recorded spring migration in "mid-June" (earliest date, May 9) in the southern Willamette Valley of western Oregon. Nighthawks have been recorded arriving in southern British Columbia and southern Alberta between May 28 and June 3 (Munro, 1945:70; Clarke and Cowan, 1945:93), and they reportedly are common in central Brit-

ish Columbia by June 10-12 (Munro, 1949:91; 1947:81). In 1938, Cowan (1939:34) noted the first arrival of this species in the Peace River region of northeastern British Columbia on May 29, and in 1921, Swarth (1924:344) first noted nighthawks at Hazelton, northern British Columbia, on June 3.

Both Rust (*op. cit.*:177) and Higgins (*op. cit.*:10) reported that females generally arrive on the nesting grounds a few days before the males.

Fall migration.—Migration in Utah begins in the last week of August and reaches a maximum of movement by the first week of September (Higgins, 1948:7-9). "Last seen" records by Higgins are October 11, 12, and 15. In northern Idaho fall movements usually begin in the last 10 days of August (Rust, 1947:187). Migration in the San Bernardino Mountains, California, was recorded on August 20, 1905, by Grinnell (1909: 68). In central British Columbia in 1945, Munro (1949:91) observed the first migrants on August 8 and the main flight on August 20, and in 1944 he recorded the first migrants on August 9 (1947:81). Many of the young-of-the-year depart southward after the main flight of adults has taken place (Rust, *op. cit.*:187). Migrants taken in the western states in the latter part of September or later in the year are almost invariably immature.

There have been several reports of fall migration in the western United States in July. A highway census of supposedly migrant birds made near Grand Canyon, Arizona, on July 29, 1941, was reported by Bryant and Bryant (1941:293). Fifty-one nighthawks were seen from a car along an 18-mile strip of desert. Another concentration of nighthawks in Arizona was reported by Bryant and Bryant (1945:268) where 287 birds crossed the highway in eight minutes near Grand Canyon Junction on August 17, 1943. The large number of birds involved in this case indicates that an annual migration was taking place. Gullion (1951:140) stated that migration in the Willamette Valley, Oregon, begins "in late July." He noted "the peak in early September, with flocks of as many as 300 birds." In view of other reports on fall migration, however, I am inclined to question these July records as being instances of annual migration. In connection with this problem, it is noteworthy that numerous local movements of feeding flocks composed of apparently breeding birds to and from an area in the Hovenweep National Monument, Colorado, were observed by Hansen (1950) from July to September. Nighthawks frequently move between their nesting area and a favorable feeding location in groups which might be mistaken for migrating flocks.

In accordance with available migration data, the general rule was adopted of considering only those birds collected between June 15 and August 15 as having been on their breeding grounds; a procedure which was strictly followed whenever questions of racial boundaries were involved. In a few other instances, however, specimens taken prior to June 15 and after August 15 were included in the breeding series when, on the basis of subspecific characters, there seemed no reasonable doubt but that they represented the breeding population of the area in which they were taken.

SUBSPECIES ACCOUNTS

Chordeiles minor minor (Forster)

Capr[imulgus] minor Forster, 1771:13.

Type locality.—South Carolina.

Range in western North America.—Breeds in typical form in Canada south to central Saskatchewan and Vancouver Island and in atypical form south in the United States to north-central and western Washington and extreme northwestern Oregon; intergrades with *hesperis* in central Oregon (Newport, Corvallis, Sparks Lake, John Day River, Umatilla), southeastern Washington (Walla Walla County, Sprague), southeastern British Columbia (Okanagan Landing) and southern Alberta

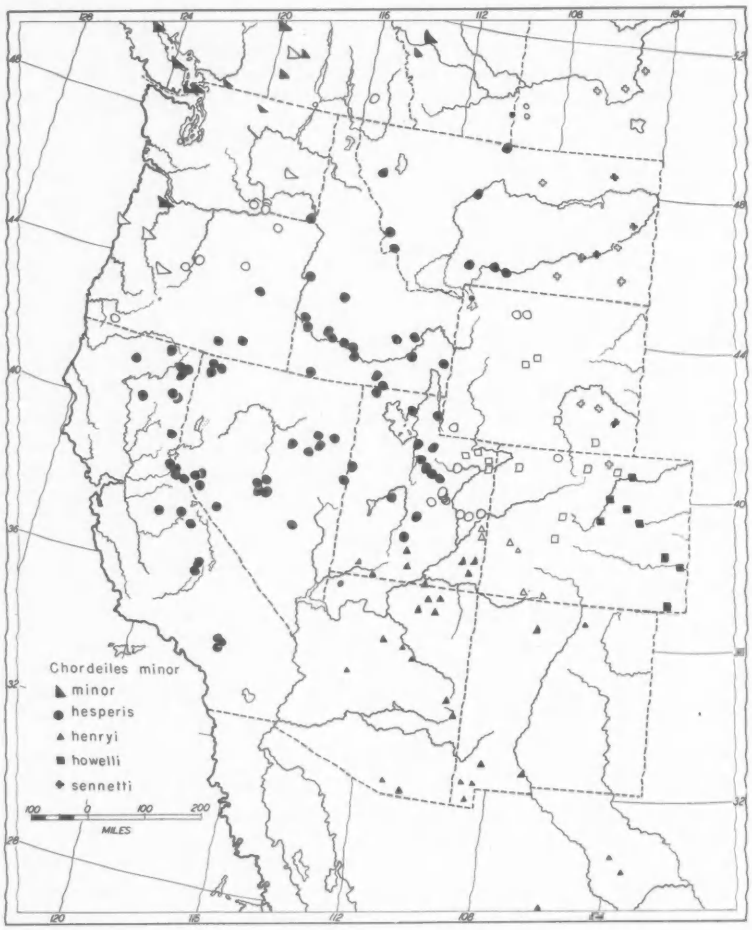

Fig. 4. Distribution of *Chordeiles minor* in western North America. Large symbols, specimens examined; small symbols, selected records from the literature. Open symbols represent intergradient samples.

(*Didsbury*). (See map, fig. 4.) Accidental at Point Barrow (Bishop, 1944:187) and Allaket (Murie, 1925), northern Alaska. Winters in South America, from Colombia and Venezuela south to Argentina.

Characters.—The darkest race occurring in western North America. Dorsal ground color usually intensely black, with the dorsal mottlings sparse, coarse, and mostly white or Cream Buff but often dark Ochraceous Buff or Tawny; streaks on nape and auricular region dark Ochraceous Buff; dark areas of the anterior under parts blackish with few dark buff spots or streaks; bars of the belly darker and wider than in other races; wing patch averages smaller than in other races, with possible exception of *henryi*; under parts washed with Warm Buff. Female differs from male in having the under

parts more conspicuously washed with buff, the dorsal ground color more brownish, and the light mottlings generally buffier or more tawny. Size rather consistently large (see table 1).

Specimens examined.—BRITISH COLUMBIA. Atlin, 4 (June-Aug.); upper Nicola River, 4000 ft., 2 (Aug.); Telegraph Creek, 3 (June); Stikine River, 1 (July); Hazelton, 959 ft., 2 (June); Clearwater P.O., 1 (June); Barriere, 1 (June); Comox, 2 (Aug.); Errington, 3 (Aug., Sept.); Okanagan Landing, 7 (June, Aug.; intergrades with *hesperis*); Fawcett, 1 (May). ALBERTA. Little Red River, Didsbury, 3 (June; intergrades with *hesperis*). WASHINGTON. San Juan County: Friday Harbor, 5 (June-Sept.). Lincoln County: Sprague, 1 (June; intergrade with *hesperis*). OREGON. Wallowa County: Wallowa Lake, 1 (June; migrant). Deschutes County: Sparks Lake, 5426 ft., 1 (July). Benton County: Corvallis, 1 (July). Lincoln County: Newport, 1 (June). Washington County: Beaverton, 3 (June, July; one specimen atypical toward *hesperis*). IDAHO. Ada County: Boise, 1 (June 11, 1942). UTAH. Weber County: Ogden Canyon, 4300 ft., 1 (May 29, 1952). Wasatch County: Midway Fish Hatchery, 5450 ft., Midway, 1 (June 9, 1944). COLORADO. Kiowa County: Eads, 1 (Sept. 13, 1941). Conejos County: Sanford, 1 (Oct. 2, 1943). Lincoln County: Limon, 1 (May 30, 1945). Weld County: Rockport, 1 (June 12, 1941).

Remarks.—Breeding birds from Okanagan Landing, British Columbia, although clearly referable to *minor*, approach *hesperis* in a number of their characters. The females, especially, differ from examples from northern British Columbia in having more abundant light dorsal mottlings, less blackish anterior under parts, and narrower ventral dark bars. Most of the males more closely resemble *minor*, although one specimen is not unlike *hesperis* in coloration. According to Oberholser (1914:39), a series of *minor* from Ashcroft and single specimens from Lac La Hache and Chilliwack, southern British Columbia, also approach *hesperis*.

Two immatures having only partly grown flight feathers and another more fully grown immature from Okanagan Landing are *minor*, while two fully grown immatures collected there on September 5 and 17 are referable to *hesperis*. The latter two may have been vagrants from a more southern region. Another possible vagrant of *hesperis* from the same locality is an adult male taken on August 11.

Two adults and an immature from Cranbrook, southeastern British Columbia, are referable to *hesperis*, although they reflect some connection with *minor*. *Hesperis* has been reported from southeastern British Columbia by a number of authors (Oberholser, 1914:48; Brooks and Swarth, 1925:71; Munro and Cowan, 1947:134-135; and Rand, 1948:29).

Breeding birds from Little Red River, Didsbury, central southern Alberta, show a slight approach toward either *hesperis* or *sennetti* in their abundance of light mottling but, as a group, they are decidedly nearer *minor*.

In western British Columbia *minor* ranges south to the international border and into northwestern Washington without apparent intergradation with *hesperis*, as shown by a series of birds from Vancouver Island and Friday Harbor, San Juan County. A transition connecting *minor* with *hesperis* continues southward through western Washington and western Oregon (see page 72).

The paucity of migrant records of *minor* in the western states suggests that the major migration route of populations of this race breeding in western Canada is through the eastern United States. A few individuals, however, pass through some of the western states in both spring and fall; specimens have been obtained in Utah (Behle, 1948:71, and Behle and Selander, 1952:28), Colorado (Oberholser, 1914:43; also specimens examined herewith), and Idaho. Two specimens referred to *minor* by Friedmann, Griscom, and Moore (1950:152) were taken in Nayarit, México, on July 9, a date unusually late for spring migration.

Chordeiles minor hesperis Grinnell

Chordeiles virginianus hesperis Grinnell, 1905:170.

Chordeiles minor twomeyi Hawkins, 1948:131 (see Todd, 1948, for correction of catalog number of type).

Type locality.—Bear Lake, 6700 feet, San Bernardino Mountains, San Bernardino County, California.

Range.—Breeds from southeastern British Columbia and southern Alberta south through southeastern Washington and eastern and southern Oregon, Idaho, western and central Montana, western Wyoming, extreme northern Colorado (west of the Front Range), central and western Utah, Nevada,

and California (Cascade-Sierra Nevada region and San Bernardino Mountains in southern California, *fide* Grinnell and Miller, 1944:209). Intergrades with *minor* in southern British Columbia, southern Alberta, southeastern Washington, and central Oregon; with *sennetti* in southern Saskatchewan and central Montana (east of the eastern slope of the Rocky Mountains); with *howelli* in south-central Wyoming (Fremont County) and northwestern Colorado (Jackson County); with *henryi* and *howelli* in the Uinta Basin of eastern Utah and western Colorado; and with *henryi* in southeastern Utah. Winter range unknown. Migrates through the southwestern states and casually east to Louisiana, Sonora, Campeche, and Nicaragua.

Characters.—Similar to *minor* but differs in having the ground color less intensely black; mottlings of the upper parts largely white, Light Buff, or Cream-Buff, finer, and much more abundant; nape streaks paler (often white); anterior under parts less blackish; ventral dark bars narrower and lighter; under parts less conspicuously washed with buff; wing patch larger, and light tail bars wider. Female similar to male but differs in having more buffy posterior under parts, the ground color occasionally lighter and more brownish; mottlings duller and less whitish, contrasting less sharply with the ground color. Size similar to *minor*.

Specimens examined.—BRITISH COLUMBIA. Burns Slough, 2950 ft., Cranbrook, 2 (Aug.); Cranbrook, 1 (Aug.); Okanagan Landing, 3 (Aug., Sept.). WASHINGTON. Asotin County: 6 mi. S Anatone, 1100 ft., 4 (July). Walla Walla County: Wallula, 1 (June); Snake River, 350 ft., 1 mi. N Burbank, 1 (July); 1 mi. "above" mouth Snake River, 350 ft., 1 (May). OREGON. Lake County: 9 mi. S Adel, 7 (May, June); Adel Lake, 1 (June). Malheur County: Beulah, 1 (June); Rome, 1 (June). Harney County: Alvord Lake, 1 (July); Burns, 2 (Aug.). The following Oregon specimens are intermediate between *hesperis* and *minor*.—Josephine County: 5 mi. E Cave Junction, 1 (July) (closely resembles *minor*). Deschutes County: Swampy Lake, 5700 ft., 13 mi. W, 3 mi. S Bend, 1 (June). Grant County: John Day River, 1 (June). Crook County: 4 mi. SW Prineville, 3300 ft., 2 (June). Umatilla County: Umatilla, 1 (July). Douglas County: Umpqua River, "near" Echo Lodge, 1 (Aug.). CALIFORNIA. Siskiyou County: Mount Shasta, 2 (July). Modoc County: Parker Creek, 5500 ft., Warner Mts., 1 (June); Squaw Mt., 1 (July); Alturus, 1 (Oct.); Crowder Flat, 5200 ft., 38 mi. NNW Alturus, 2 (June); Likely and "near" Likely, 2 (June); Eagleville, 2 (June, Sept.). Shasta County: 2 mi. SE Old Fort Crook, 3400 ft., 1 (July). Tehama County: Dales, 600 ft., on Paines Creek, 1 (May); Lymans, 3300 ft., 4 mi. NW Lyonsville, 1 (June); Dutch Flat, 3400 ft., 1 (Aug.). Sierra County: Loyalton, 1 (June). Placer County: Cisco, 1 (June). Nevada County: Donner, 1 (July). Lassen County: Petes Valley, 4500 ft., 1 (July); Eagle Lake, Spaldings, 7 (June, July). El Dorado County: Echo Lake, 8700 ft., 1 (June); Bijou, 2 (Aug.); Stateline, 1 (June). Alpine County: Hope Valley, 3 (Aug.); 2 mi. NE Woodfords, 5700 ft., 1 (June). Tuolumne County: Tuolumne Meadows, 1 (July); Sierra Nevada, 1 (June). Mariposa County: Dudley, 3000 ft., 3 (Aug.). Fresno County: Shaver Railroad Station, 5300 ft., 2 (July). Tulare County: Troy Meadows, 1 (Aug.); Trout Creek, 4 (July); Jackass Meadow, 7750 ft., 1 (July). Inyo County: Grays, Kearsarge Pass, 2 (June); Independence, 2 (July). Mono County: Leavetts Meadow, 1 (Aug.); 11 mi. S Benton Station, 1 (Aug.); 1¼ mi. ESE Leevining, 6450 ft., 1 (June). San Bernardino County: Bluff Lake, 7500 ft., 10 (July); Fish Creek, 9000 ft., 1 (June); South Fork Santa Ana River, 6200-7000 ft., 5 (June, July); Sugarloaf, 7500 ft., 1 (Aug.); Summit, 1 (Sept.). NEVADA. Humboldt County: Big Creek Ranch, 4350 ft., base Pine Forest Mts., 1 (June); Virgin Valley, 1 (June). Elko County: Harrison Pass R.S., Green Mt., 2 (June); W side Ruby Lake, 17 mi. N Elko County line, 2 (July). Eureka County: Winzell, 1 (June). White Pine County: Baker Creek, 8000 ft., 4 (July); 7 mi. SE Hobsen P.O., 1 (July). Washoe County: mouth Little High Rock Canyon, 5000 ft., 1 (June). Lyon County: 6 mi. S Yerington, 4300 ft., 2 (June). Mineral County: E Walker River, 5100 ft., 2 mi. NW Morgans Ranch, 1 (July); 5.5 mi. NNW Sweetwater, 7400 ft., 1 (July); 2 mi. SW Pine Grove, 7250 ft., 2 (June). Esmeralda County: Fish Lake, 4800 ft., 2 (June). Nye County: Millet P.O., 5500 ft., 2 (Aug.); 1 mi. E, 1.5 mi. SE Jefferson, 7600-8600 ft., 2 (Aug.); Garden Valley, 8.5 mi. NE Sharp, 1 (June); Greenmonster Canyon, Monitor Range, 1 (July); Monitor Valley, 9 mi. E Toquima Peak, 7000 ft., 1 (July). IDAHO. Washington County: Weiser, 1 (June). Gem County: Montour, 4 (Aug.) (atypical, migrants?). Fremont County: 17 mi. E, 14 mi. N Ashton, 6275 ft., 1 (Aug.). Butte County: Big Butte, 2 (July); Birch Creek, 1 (Aug.). Bannock County: Pocatello, 1 (June). Bonneville County: 17 mi. W Idaho Falls, 2 (July). Cassia Counnty: Elba, 2 (June); Stanrod, 2 (June, Aug.). Boise County: 7 mi. E Lowman, 1 (June). Owyhee County: Indian Creek, 5500 ft., 2 mi. SW Riddle, 2 (June). Elmore County: Ham-

mett, 1 (June); 4 mi. SE Kinghill, 1 (June); Glenns Ferry, 6 (July); Mountain Home, 3 (July). Canyon County: Nampa, 2 (Aug.; atypical, migrants?); 2 mi. SW Melba, "Owyhee" County, 2 (June); Walters Ferry, 3000 ft., 5 mi. SW Melba, 12 (Aug.). Custer County: 3 mi. W Red Fish Lake, 1 (Sept.). Twin Falls County: Buhl, 9 (July). Gooding County: Hagerman, 5 (July). Caribou County: Blackfoot River Reservoir, 6000 ft., 1 (June). UTAH. Box Elder County: Junction Reservoir, 6200 ft., 3 mi. S Lynn, 12 (July); Johnson Creek, 5600 ft., 4 mi. S Yost, 3 (June); Duckville Gun Club, mouth Bear River, 1 (June); Hansens Island, mouth Bear River, 1 (Sept.). Juab County: Queen of Sheba Mine, 8000-8500 ft., Deep Creek Mts., 2 (July, Sept.). Tooele County: Rush Valley, south of Benmore, 1 (June). Rich County: Woodruff, 9 (Aug.). Salt Lake County: 4 mi. N Salt Lake City, 4250 ft., 1 (Aug.); Big Cottonwood Canyon, 1 (June; intergrade with *howelli*; migrant). Summit County: 12 mi. E Oakley, 7500 ft., 15 (July). Wasatch County: Parleys Park, 4 (June, Aug.); Midway Fish Hatchery, 1 (June). Utah County: Mount Timpanogos, 1 (July); Colton, 5 (Aug.); Provo, 1 (Sept.); 10-15 mi. E Thistle, 5300 ft., 3 (July); Castella, 4 mi. NW Thistle, 1 (June); Fairfield, 1 (June). Duchesne County: 5 mi. N Duchesne, 5. Carbon County: 3 mi. S Helper, 4; 3-4 mi. N Wellington, 7; 3 mi. N–3 mi. S–1.5 mi. SE Price, 4; Price River, 5500 ft., Price, 2 (Sept.); Soldier Canyon, 3; 3 mi. S Hiawatha, 5. Sevier County: junction Salina and Fish Lake roads, 3 (Aug.). Wayne County: Loa, 2; Fruita, 1 (June). Millard County: Oak City, 6 (Aug.). Iron County: Buckskin Valley, 1 (Sept.). Grand County: Elgin, 1 (Aug.); Sego, 1 (Aug.); Cisco, 2 (July; intergrades with *henryi*. MONTANA. Sanders County: Camas Creek, 4 mi. S Fort Logan, 1 (Aug.). Ravalli County: Corvallis, 1 (July); "near" Sula, 2 (Aug.). Cascade County: Great Falls, 1 (July). Meagher County: 5 mi. NE Ringling, 1 (Sept.). Hill County: Milk River at 49° north latitude, 1 (July). Gallatin County: Bozeman, 1 (Aug.). Valley County: Johnson Lake, 1 (June 3, 1910). Stillwater County: Reed Point, 2 (June). Sweet Grass County: Big Timber, 2 (June). Beaverhead County: Birch Creek, 7100 ft., 18 mi. NW Dillon, 1 (July). Unlocated: Upper Geyser Basin, 1 (Aug.). WYOMING: Uinta County: Fort Bridger, 2 (June). Big Horn County: Greybull, 5 (June; breeding?); Germania, 2 (June). COLORADO. Jackson County: Walden, 7 (July; intergrades with *howelli*). The following Colorado specimens were probably migrants.—Lincoln County: Limon, 2 (Aug. 1, 1945). Kiowa County: Eads, 3 (May 28, 1941, Sept. 13, 1941, Sept. 24, 1939). Moffat County: Unspecified, 1 (June 3, 1924). Weld County: Greasewood, 1 (Aug. 12, 1939). Conejos County: Sanford, 1 (Oct. 2, 1943). Yuma County: Dry Willow Creek, 1 (Aug. 24, 1915). Unlocated: Henderson, 1 (Sept. 19, 1942). ARIZONA. Cochise County: Huachuca Mts., 1 (Aug.; migrant). MÉXICO. SONORA: 10 mi. S Nogales, 1 (Oct. 2, 1946).

Remarks.—In describing *twomeyi* from the Snake River region of southern Idaho, with type locality 2 miles southwest of Melba, 3000 feet, Owyhee [= Canyon] County, Hawkins (1948:32) remarked that it is "intermediate between *hesperis* and *sennetti* . . . [resembling] *sennetti* in the lightness of the underparts and *hesperis* in the darkness of the back." He listed four specimens, three from Idaho and one from Lake County, Oregon; one of these, according to Hawkins, shows "slight intergradation towards *hesperis*." He did not specify localities of material which he considered as *hesperis*.

For the present study I have had opportunity to examine 51 breeding birds from southern Idaho, including the type of *twomeyi*. The type is fairly representative of the average of that population as regards dorsal markings but is lighter than average ventrally. Series of skins from southwestern Idaho are not separable from series from northwestern Utah. Birds from Nevada differ slightly from Idaho specimens in having the dorsal mottlings more often cream-buff in color rather than predominantly white or pale buff. In addition, birds from Nevada show a wider range of individual variation in amount of light dorsal mottling than do those from Idaho and northwestern Utah, which are, as nighthawks go, remarkably uniform in this respect.

Birds from central and northern California are even more variable than those from Nevada, there being an increase in the number of variants having a reduced amount of light mottling, slightly wider ventral bars, and a suffusion of pale ochraceous buff ventrally and, to a lesser extent, among the dorsal mottlings. The type and paratypes of *hesperis* from the San Bernardino Mountains of southern California have faded and browned with age but are similar to specimens of like age from central and northern California.

It should be noted that there are no systematically useful size differences between birds from California and the Great Basin (table 1), although California specimens average a bit greater in length of tail.

Despite the fact that series of ten or more birds from California usually are separable from series of specimens from the Snake River drainage region, several circumstances argue against nomenclatural recognition of this differentiation. In the first place, segregation of mixed specimens from the two regions is on the order of only 70 per cent from 70 per cent. As an example, in working with series of 30 skins, if approximately 30 per cent (9 specimens) of the lightest California birds and a like percentage of the darkest specimens from Idaho were discarded, it was possible to correctly segregate the remaining birds with respect to locality. This degree of differentiation falls short of most standards currently advocated for subspecific separation (Rand and Traylor, 1950; Amadon, 1949), including the criterion of 90 per cent from 90 per cent suggested by Mayr, Linsley, and Usinger (1953:145) and is of a lesser order than that existing between currently recognized races of this species. Secondly, populations in western Montana and the mountainous regions of central Utah currently regarded as racially identical with those of the Great Basin show a darkening which parallels that of California birds (page 71).

Progressing northward from California into Oregon, a situation is encountered wherein birds from the eastern part of Oregon (Lake County) are uniformly like those from Idaho, whereas specimens from the extreme northwestern part of the state are highly variable but referable to *minor* by reason of their dark ground color, marked reduction in amount of light dorsal mottling, and increased width and darkness of their ventral bars. Specimens are available from the central part of the state which are intermediate to varying degrees between *hesperis* from southern Idaho and *minor* to the north in British Columbia (see map, fig. 4). These birds resemble some of the darker California specimens. An adult female taken on July 25 in Josephine County, Oregon, just north of the California border, resembles typical *minor* but is at present perhaps best regarded as an extreme variant of *hesperis*.

The situation apparently is similar in Washington. Of six specimens available from the southeastern part of the state (Walla Walla and Asotin counties), four are like *hesperis*, one is intermediate between *minor* and *hesperis*, and another is not unlike some lighter examples of *minor*. A bird from Sprague, Lincoln County, in the east-central part of the state, is very dark dorsally and has unusually wide ventral bars, being, on the whole, more like *minor* than *hesperis*. Farther to the northwest, in San Juan County, typical *minor* occurs as mentioned in the account of that race. *Minor* also has been reported from the northern Cascade Mountains (Burdick, 1944:239).

Two adult males from Nampa, Canyon County, Idaho, August 23, 1913, an adult female from 3 miles west of Red Fish Lake, Custer County, Idaho, September 7, 1947, and four birds (two adult males and two females) from Montour, Gem County, Idaho, August 20, are quite unlike the breeding birds of southern Idaho in that they show a marked reduction in the amount of light mottling. Considering the dates of their collection, it is probable that they were migrants, presumably from an area of intergradation between *hesperis* and *minor*.

The eastern limits of distribution of *hesperis* are discussed beyond in connection with the distribution of *howelli* and *sennetti*.

Chordeiles minor henryi Cassin

Chordeiles Henryi Cassin, 1855:239.

Type locality.—Fort Webster, [Dona Ana County,] New Mexico.

Range.—Breeds from central-northern México (southern Durango) north through Arizona, New Mexico, and extreme western Texas to southeastern Utah (Wayne and Garfield counties, La Sal Mountains) and southwestern Colorado (Mesa County), where intergradation with *hesperis* and *howelli* occurs. Accidental (?) near Minco, Oklahoma (Wetmore, 1918:7). Winter range unknown; presumably South America; migrant records from Texas, Louisiana, México, and British Honduras (Austin, 1929:367); there is a June record from Colombia.

Characters.—Somewhat similar to *hesperis* but differs in having the ground color browner and more rufescent, less intensely black; dorsal mottlings coarser and mostly Tawny or Cinnamon-Rufous instead of white or Light Buff; under parts usually extensively suffused with buff or light Tawny; anterior under parts more rufescent, near Cinnamon-Rufous, less blackish, and usually spotted with Tawny, and the bars of the under parts averaging narrower and lighter, more rufescent; size of wing patch variable, but most frequently smaller than in other races, being especially reduced on 9th and

10th primaries where white often is restricted to the inner web even in adult-winged birds. Similar also to *howelli* but differs in a number of characters mentioned in the diagnosis of that race (page 74). Female dorsally much like male but usually has a more extensive and intensive suffusion of buff on the posterior under parts. Size similar to *howelli*.

Specimens examined.—MÉXICO. CHIHUAHUA: Colonio Pacheco, 2 (April, June); Río Gavilán, 6700 ft., 7 mi. SW Pacheco, 4 (July, Aug.). DURANGO: 29 mi. WNW Ciudad Durango, 1 (July); 30 mi. W Ciudad Durango, 8000 ft., 1 (June). COLORADO. Mesa County: Escalante Forks, 2 (July). La Plata County: Animas River, 5 (June). Archuleta County: "near" Navajo River, 1 (July). NEW MEXICO. Curry County: 4 mi. W, 3 mi. N Clovis, 1 (Aug.; migrant?). Grant County: Apache, 1 Aug.). Dona Ana County: Radium Springs, 2 (June). Hidalgo County: Double Adobe, 1 (June; intergrade with *howelli*; migrant?). Rio Arriba County: 18 mi. E Cuba, 4 (Aug.). ARIZONA. Cochise County: Huachuca Mountains, 8 (June-Aug.). Coconino County: Red Lake (Tonales), 5800 ft., 1 (July); 38 mi. N Flagstaff, 6500 ft., 2 (Aug.); 3 mi. S Dry Park R. S., Kiabab Forest, 1 (June). Navajo County: Shonto Canyon, 6600 ft., 2 mi. SE Trading Post, 1 (July); Kayenta, 5800 ft., 1 (July); Black Mesa, 1 (Aug.). Apache County: White Mts., 22 mi. E Alpine, 1 (Aug.); Three Forks, 8300 ft., 20 mi. S Springerville, 1 (June). UTAH. San Juan County: 5 mi. SE Navajo Mt., 1 (June); Navajo Mt., 10,500 ft., 1 (July); La Sal, 4 (Aug.); Jackson Ridge, 25 mi. N Blanding, Abajo Mts., 2 (July); Blanding, 1 (Aug.); 9 mi. N, 14 mi. E Monticello, 10 (July, Aug.); Geyser Pass, La Sal Mts., 1 (July). Kane County: 3 mi. S Kanab, 2 (June). Wayne County: Donkey Lake, Boulder Mts., 1 (July). Garfield County: 10 Mile Spring, "south" Escalante, 1 (June); 5 mi. W Boulder, 6500 ft., 5 (July). Grand County: Warner Ranger Station, La Sal Mts., 4 (July). TEXAS. Brewster County: Marathon, 2 (May). Hidalgo County: Pharr, 1 (April).

Remarks.—Oberholser (1914:65) restricted the name *henryi* to the dark, tawny birds of the southwestern United States and México. His basis for the inclusion of southwestern Colorado within the range of this race was a specimen from Montrose, Montrose County. Specimens were not then available from southern Utah. Subsequently, Benson (1935:433) listed a specimen of *henryi* from Navajo Mountain, San Juan County, Utah, and Hayward (1940:94-95) advocated extending the range of *henryi* northward in Utah to the Uinta Basin (see page 76). Woodbury and Russell (1945:59) referred breeding birds of the Navajo country of southeastern Utah and northeastern Arizona to this subspecies.

These specimens, along with additional unreported material, have been examined in connection with the present study. Those from northeastern Arizona and Navajo Mountain, San Juan County, Utah, are "good" *henryi* and are rather uniform in appearance. Northward from the Utah-Arizona border, variability increases with evidence of an approach toward *hesperis*. A specimen from Boulder Mountain, Wayne County, and six birds from Garfield County are *henryi*, as are two from near Kanab, Kane County. Birds from Blanding and Monticello, San Juan County, are variable but, as a group, can be placed with *henryi*. About half of them verge toward *hesperis* in having an increase in the amount of light buffy mottling (as compared to the more tawny hue of *henryi*) and a reduction in the intensity of the buffy wash on the under parts. Some specimens thus closely resemble browner examples of *hesperis* from the Great Basin.

Specimens from La Sal, San Juan County, and the La Sal Mountains, Grand and San Juan counties, and Cisco, Grand County, also are intermediate, with some tendency for reduction of buff ventrally. One from La Sal is much like *hesperis*, for the most part lacking any tawny, and another from the same locality is intermediate between *howelli* and *henryi*. Two from the La Sal Mountains are like *howelli* and were so identified by Oberholser in 1938, apparently at the same time that he identified two other specimens from the same locality as *henryi* (Hayward, 1940:95). The occurrence of these variable birds in the region of the La Sal Mountains was interpreted by Hayward (*loc. cit.*) as indication of an overlap of the breeding ranges of *hesperis*, *howelli*, and *henryi* so that the three races breed in the same geographic area. However, in the absence of evidence of altitudinal segregation which would permit such an overlap and in view of the fact that birds from this region are no more variable than certain populations in western Colorado, Wyoming, and south-central Montana, they should be referred to only one subspecies. Taken as a group, then, these specimens average closest to *henryi*, to which race they may be allocated.

A bird from Sego, central Grand County, Utah, and one from Elgin, Grand County, are referable

to *hesperis*. Two from Cisco, Grand County, also are like *hesperis* but are browner than examples of that race from the Great Basin. Further work may show that the majority of birds from central Grand County are nearer *henryi* since birds of the Uinta Basin to the north seem to show a connection with that form (see page 75); but on the basis of material presently available, I have assigned birds from central and western Grand County to *hesperis*.

Two partly grown immatures from Escalante Forks, Mesa County, Colorado, are tawny dorsally and represent *henryi*, indicating that this is the breeding form in southwestern Colorado. Specimens from Animas River, La Plata County, and Navajo River, Archuleta County, just north of the Colorado-New Mexico border also are referable to *henryi*.

Burleigh and Lowery (1940:104) indicated that *howelli* is the breeding race of the Guadalupe Mountain region of western Texas on the basis of specimens collected on June 9, 12, and 17. However, at least the first of these dates is too early in the year to preclude the possibility of the birds being migrants. It should be noted that *henryi* reportedly is the breeding form in Brewster County, to the south, where *howelli* is a spring migrant (Van Tyne and Sutton, 1937:40-41).

Within the range of *henryi* there is a north-south cline in color. As noted by Oberholser (1914:66), breeding birds from México represent the extreme differentiation of the race in being consistently darker than birds from northern Arizona and New Mexico. This gradient is even more apparent now that specimens are available from as far south in México as southern Durango (Webster and Orr, 1952:310). The darkness of these southern birds involves an increase in intensity of the ground color, tawny markings, ventral bars, and general suffusion of buff or tawny ventrally. Progressing northward these features tend to lighten until the extreme in this direction is achieved in the Colorado Basin region of Utah and Colorado where transition to *hesperis* and *howelli* occurs.

Chordeiles minor howelli Oberholser

Chordeiles virginianus howelli Oberholser, 1914:57.

Type locality.—Liscomb, Liscomb County, Texas.

Range.—Breeds in typical form in north-central Texas, central and western Oklahoma, western Kansas, and eastern Colorado; in less typical form in central Colorado, northeastern Utah (Uinta Basin), and south-central Wyoming. Intergrades with *henryi* in southwestern Colorado; with *hesperis* and *henryi* in the Uinta Basin of northeastern Utah and northwestern Colorado; with *hesperis* in north-central Wyoming (Fremont County) and extreme northern Colorado (west of the Front Range); and with *sennetti* in northeastern Colorado (Weld and Morgan counties). Winter range unknown; presumably South America. Migrates through the central southern states (casually east to Louisiana and Mississippi), Campeche, México, and Nicaragua.

Characters.—A variable race, more or less intermediate between *henryi* and *sennetti*. Differs from *sennetti* in having the ground color more brownish-rufescent (less grayish-black), dorsal mottlings much more buffy or ochraceous (Ochraceous Buff), under parts buffier throughout, and the anterior areas of the under parts more ochraceous (less blackish gray). Differs from *henryi* in having the ground color slightly browner (less blackish), dorsal mottling more abundant, finer, and less deeply buffy or tawny, ventral bars lighter and narrower (often broken posteriorly), under parts lighter (less tawny), and wing patch larger. The female is quite unlike the male dorsally in that the mottlings are almost entirely deep buff instead of pale buff and whitish. Additionally, the female is usually darker below than the male, being quite similar in this respect to the female of *henryi*. Size about intermediate between *sennetti* and *hesperis*.

Specimens examined.—COLORADO. Unspecified, 2 (June). Baca County: Jimmie Creek, 1 (May); Campo, 2 (May, Aug.). Prowers County: Holly, 4 (May, Aug., Sept.). Kiowa County: Eads, 9 (May, Aug.). Yuma County: Wray, 1 (May). Morgan County: Jackson Reservoir, 7 (May, July, Aug.). Larimer County: Estes Park, 2 (Aug.; atypical; breeding?). Adams County: Barr, 3 (June, Aug.). Arapahoe County: Deer Trail, 1 (May). Denver County: Denver, 2 (July, Oct.). Douglas County: Jarr Canyon, Sedalia, 1 (July). Weld County: unspecified, 1 (July); Pierce, 9 (July); Greasewood Lake, 3 (June, July; intergrades with *sennetti*). Lake County: 3 mi. S Leadville, 10,000 ft., 1 (June3. Chaffee County: Clear Creek, 1 (June). Gunnison County: Tincup, 3 (July; atypical). WYOMING. Albany County: Laramie River, 1 (Aug.); Laramie Peak, 2 (June). Fremont County: "N of" and "near" Sandraw, 3 (June); 8 mi. E by S Lost Cabin, 1 (June; atypical toward *hesperis*).

Carbon County: Saratoga, 1 (June); 25 mi. E, 10 mi. S Saratoga, 9800 ft., 1 (Sept.). UTAH. Box Elder County: Hansens Island, mouth Bear River, 1 (Sept.; migrant). Duchesne County: Timothy Creek, 7500 ft., 10 mi. N Altonah, 4 (June). Uintah County: 2 mi. S Vernal, 1 (Aug.); Vernal Game Refuge, 5500 ft., 3 mi. S Vernal, 1 (Sept.); 7 mi. N Vernal, 1 (Aug.); 3 mi. E Vernal, 7 (Aug.); Jensen, 3 (July). Carbon County: 3 mi. S Helper, 1 (Aug.; migrant?). Wayne County: Loa, 1 (Sept.; migrant). Salt Lake County: Salt Lake City, 1 (Sept.; migrant); mouth Big Cottonwood Canyon, 1 (June; migrant). Wasatch County: Midway Fish Hatchery, 5450 ft., 3 (June; migrants). Washington County: junction Virgin and Santa Clara rivers, 2700 ft., 2 mi. S St. George, 1 (Sept.; migrant). TEXAS. Brewster County: 4-20 mi. S Marathon, 5 (May; migrants).

Remarks.—Material examined in connection with the present study indicates that the light, buffy population which Oberholser (1914:57) named *howelli* extends westward in typical form only to eastern Colorado. In central and western Colorado, central Wyoming, and south-central Montana a complex situation exists with regard to the distribution of racial characters. Samples from these areas are so highly variable that breeding individuals resembling any one of the western races frequently are collected at the same locality. Oberholser (*op. cit.*:58-59) referred birds from these areas to *howelli,* but his limited material could not reveal the full complexity of variation.

In Utah the lightly mottled, dark ground-colored race *hesperis* occupies all of the Great Basin part of the state (page ....) and extends eastward in fairly typical form through the Wasatch Mountains. In extending the range of *howelli* west to the Wasatch Mountains of central-northern Utah, Oberholser (*op. cit.*:59) referred to that race four specimens collected by Robert Ridgway at Parleys Park (Kimballs Junction-Snyderville area, Summit County) in 1869. I have examined two of these and find that one is more like *hesperis* than *howelli* and the other is somewhat buffier dorsally than most examples of *hesperis* from the Great Basin. Both of these specimens have, however, foxed considerably so that an accurate evaluation of their characters cannot be made. It is evident that they bear no close relationship to populations of *howelli* in eastern Colorado since a series of 15 specimens recently collected at a locality directly east of Parleys Park, namely 12 miles east of Oakley, Summit County, is very similar to series of *hesperis* from Idaho and western Utah. Several males, however, have their under parts more noticeably suffused with pale buff and the mottlings of the dorsum and anterior lower parts less numerous and decidedly buffy. The darkness and buffiness of these birds parallels the variation of California specimens of *hesperis* (page 71).

A series of nine specimens from Woodruff, Rich County, about 60 miles north of Oakley, shows comparatively little individual variation and is representative of *hesperis.* Birds from near Colton, Thistle, and Hiawatha, Utah County, all of which localities are in a line south of Oakley, also are *hesperis,* although one variant, a male from 4 miles northeast of Thistle, resembles typical *howelli* from eastern Colorado.

Farther to the east within the Uinta Basin of northeastern Utah and northwestern Colorado individual variability increases, with an increased frequency of occurrence of buff in the dorsal mottlings. This variability is perhaps in part a result of the meeting of populations of *hesperis, howelli,* and, possibly, *henryi* in that area. This has been noted in the literature of the birds of that region. For example, Hayward (1940:94) recorded as *henryi* a breeding female with two juveniles from Jensen, Uintah County. The adult bird is indistinguishable from many examples of *henryi* from Arizona while the immatures are intermediate between *howelli* and *henryi,* showing many tawny markings characteristic of the latter race. On the basis of 11 specimens, six of which may be assumed to have been breeding, Twomey (1942:401) referred birds of the Uinta Basin to *howelli.* Most of these specimens are like *howelli* but are somewhat darker ventrally and have less numerous dorsal mottlings than do typical examples of that race. Twomey also collected a specimen which was called *henryi* from a large flock at Elk Springs on July 23, 1937. Two others collected from the same flock were assigned to *howelli.* He remarked (*op. cit.*:402) that "the nesting ranges of *howelli* and *henryi* meet approximately in the region of the Uinta Basin." The specimen from Elk Springs is a first-year bird which is abnormal in several respects. It was sexed as a male and has the well defined white throat crescent of that sex but lacks a subterminal tail bar. As regards size it is exceedingly small (wing 173 mm., tail 97 mm.) and is, in fact, the smallest first-year specimen of this species I have examined. In general coloration it resembles *henryi.*

Further evidence of the variable nature of the Uinta Basin population is supplied by three males

and four females from near Vernal, Uintah County. The females resemble *howelli* in having a brown cast to the ground color and predominantly buffy mottlings, but these markings are rather coarse and sparsely distributed, suggesting *henryi*. The males, however, are much like Great Basin birds (*hesperis*) from which they differ in having a lighter ground color and a faint wash of buff ventrally. In these characters they approach either *howelli* or *henryi*.

Another interesting case of variation of birds in this region is shown by four specimens from Timothy Creek, 10 miles north of Altonah, Duchesne County. Two females are essentially like *henryi*, one male is fairly typical of *hesperis*, although the ground color is rather light, and the other male has an unusual abundance of light mottlings and resembles *sennetti*.

Specimens from near Duchesne, Duchesne County, are referable to *hesperis* but are variable and have too light a ground color for that race. Females from this locality are buffier than typical examples of *hesperis*.

Series from Carbon County (Helper, Price, Wellington), south of the Uinta Basin, indicate the occurrence there of a very heterogeneous population. Some birds are nearly typical *hesperis* while others show a considerable abundance of buffy dorsal mottlings. The ground color of the latter group is rather dark, suggesting that their buffy mottlings result from an affinity with *henryi* rather than *howelli*. As a group birds from this region are referable to *hesperis*.

In summary, the range of *hesperis* may be extended eastward in Utah to Duchesne. The buffiness evident in the majority of birds from the eastern part of the Uinta Basin could represent intergradation between *hesperis* and *howelli*, *hesperis* and *henryi*, or a combination of the three. The occurrence there of a number of females approaching *henryi* would seem to indicate that the influence of that race is a factor. I have, nevertheless, assigned all breeding birds from the eastern Uinta Basin to *howelli*, since the majority of them most closely resemble that form.

Specimens from the mountainous central part of Colorado (Gunnison and Chaffee counties) differ from eastern Colorado birds in having a lesser amount of mottling and a reduction in intensity of buffiness both dorsally and ventrally. Several specimens resemble *hesperis* more closely than they do *howelli*.

I have examined an interesting series taken in July just west of the Front Range, at Walden, Jackson County, Colorado. The five males agree closely in their characters with Idaho birds although buffy mottlings are more prevalent and the majority of the specimens have a slightly browner shade to the ground color. The lone female of the series does not differ significantly from *howelli* from eastern Colorado. The fact that these birds were collected in July would tend to rule out the possibility of their having been migrants. Two specimens from Estes Park, Larimer County, central northern Colorado, taken on August 3, are very dark and have sparse mottlings. They were considered as migrants of *hesperis* by Oberholser (1914:50) but it is more probable that they were breeding inasmuch as they are similar to birds from Chaffee and Gunnison counties.

Material from Wyoming shows the same high degree of variability seen in that from western Colorado and eastern Utah. Four birds are available from Fort Bridger, Uinta County, in the southwestern corner of the state. They were referred by Oberholser (1914:64) to *howelli*, although he (*op. cit.*:60-61) mentioned three of the four as examples of extreme individual variation, commenting that one is "much like some specimens of *hesperis*," another is "somewhat like . . . *hesperis*," and still another "very much resembles . . . *sennetti*." I have examined two of these specimens; one is like *hesperis* and the other inclines toward *howelli*. Two specimens from Carbon County, central southern Wyoming, are similar to the Fort Bridger specimens but they may have been migrants (Oberholser, *op. cit.*:49). Four from central Wyoming (Fremont County) are intergradient between *hesperis* and *howelli* but nearer the latter, as are specimens from Laramie Peak and Laramie River. A series taken between June 14 and 20 at Greybull and two specimens from Germania, northern Wyoming, may not represent the breeding population, but in any event the specimens are highly variable, individuals resembling *hesperis* (or *minor*), *howelli*, and *sennetti* being present. Specimens from Yellowstone Park have been referred to *hesperis* (McCleary, 1939).

In Montana birds from along the western border are similar to California specimens of *hesperis*. Those from the central part of the state are highly variable, showing nearly the full range of variation of all the western races. For example, one from Crow Agency, Big Horn County, is typical *sennetti*, one from 12 miles southwest of Powderville, Powder River County, approaches *minor*, another from

the same locality is intermediate between *sennetti* and *howelli*, and one from 5 miles south of Forsyth, Rosebud County, is like *hesperis*.

The application of racial names to birds from the Rocky Mountain region is difficult. However, it seems advisable to refer all breeding birds from eastern Montana to *sennetti* and to draw the boundary between that subspecies and *hesperis* in that state along the eastern edge of the Rocky Mountains. As for Wyoming and western and northwestern Colorado, individual specimens and series have been provisionally assigned to the neighboring race which they most closely resemble (see map, fig. 4) and no attempt has been made to draw definite racial boundaries.

Chordeiles minor sennetti Coues

[*Chordeiles popetue*] *Sennetti* Coues, 1888:37.

Type locality.—50 miles west of the Pembina Mountains, [Towner County (?),] North Dakota.

Range.—Breeds in southern Saskatchewan, extreme southwestern Manitoba, North Dakota, South Dakota, northwestern Iowa, northern Nebraska, eastern Montana (east of the Rocky Mountains), eastern Wyoming, and extreme northeastern Colorado (east of the Front Range). Intergrades with *minor* in central Saskatchewan and southwestern Manitoba; with *hesperis* in central Montana and central Wyoming; and with *howelli* in northeastern Colorado (Weld County). Winter range unknown. Migrates through Colorado, Texas, and Oklahoma, casually east to Ohio and Florida; there is an October record from Panamá (Griscom, 1932:328).

Characters.—The palest western North American race. Similar to *hesperis* but differs in having a lighter (less intensely black) ground color which usually is restricted to the subterminal portion of the contour feathers; mottlings, including those of the nape, more abundant, finer, lighter (ashy white and Light Buff), and more vermiculiform; anterior under parts grayer; ventral dark bars narrower and lighter and often broken in the extreme posterior region. Female differs from the male in having a lighter and more brownish ground color, mottlings duller, coarser, and more tinged with Light Buff (not so whitish), anterior under parts more brownish (less grayish), and the posterior under parts washed with grayish-buff, thus often resembling female *hesperis*. Tail length averages shorter than in *minor* and *hesperis*.

Specimens examined.—SASKATCHEWAN. Imperial, 3 (June); 3 mi. W Elbow, 2 (June); 12 mi. SW Davidson, 1 (June); 6 mi. W Amazon, 1 (June). COLORADO. Weld County: Grover, 1 (July); atypical variant); Rockport, 6 (July; intergrades with *howelli*). Douglas County: Parker, 2 (Sept. 20, 1936; migrant). Denver County: City Park, Denver, 1 (Sept. 25, 1913; migrant). Adams County: Barr, 1 (Aug. 8, 1910; migrant). Prowers County: Holly, 1 (Sept. 18, 1916; migrant). Yuma County: Dry Willow Creek, 1 (Aug. 18, 1915; migrant). Unlocated: Henderson, 1 (Sept. 19, 1942). WYOMING. Platte County: Uva, 1 (July). Albany County: Little Medicine, 2 (Aug.). MONTANA. Valley County: Strater, 2 (July). Dawson County: Darnalls, 30 mi. S Glasgow, 1 (July). Custer County: Fort Keogh, 1 (June); 3 mi. S Miles City, 1 (June). Phillips County: Ruby Creek, Zortman, 1 (July). Big Horn County: Crow Agency, 1 (July). Prairie County: Terry, 4 (June). Powder River County: 12 mi. SW Powderville, 2 (June; atypical). Rosebud County: 5 mi. S Forsyth, 2750 ft., 1 (June). Unlocated: Lismas, 2 (June). NORTH DAKOTA. Souris River, 1 (Aug.). Pembina County: Pembina, 1 (June). Dickey County: Oakes, 2 (July). McHenry County: 8 mi. N Towner, 2 (Aug.); Drake, 1 (Aug.). Morton County: Fort Rice, 2 (June); Glen Ullin, 2 (July). Emmons County: Linton, 1 (June). Ward County: Kenmare, 2 (July). Mountrail County: 6 mi. N Lostwood, 6 (Aug.). Burleigh County: Bismark, 1 (July). Unlocated: Sentinel Butte, 1 (June). IOWA. Boone County: 4 mi. SE Boone, 1 (Oct.; migrant). NEBRASKA. Keya Paha County: Carns, 1 (July). WISCONSIN. Dane County: Madison, 2 (June).

Remarks.—Individual variation in this race is especially marked and while the majority of birds are easily separable from *hesperis*, many individuals approach *hesperis* in having a reduction in the amount of dorsal mottling. In the other direction extreme examples of *sennetti* have their light vermiculations so numerous as to all but eliminate the ground color.

The extension of the breeding range of *sennetti* into northern Colorado (see map, fig. 4) is based on a series of six specimens, five males and one female, taken at Rockport, Weld County, on July 11 and 19. They are not quite typical of that race, however, in that certain of them show an approach toward *howelli* in having some buffy dorsal markings. The female is more like *howelli* than *sennetti*.

A short distance to the south of Rockport, at Pierce, Weld County, and Jackson Reservoir, Morgan County, the breeding birds also are intergradient but are referable to *howelli*; and still farther south, at Barr, Adams County, typical *howelli* occurs. Hence, the transition between the two races takes place over a relatively limited area.

The extreme development of racial characters occurs in North Dakota, with a transition to darker birds taking place across eastern Montana which finally connects with populations of *hesperis* in central Montana. This darkening involves an increase in intensity of the ground color, a reduction in amount of dorsal mottling, and an increase in width and darkness of the ventral bars.

Oberholser (1914:48) stated that breeding birds from Maple Creek and Indian Head, southern Saskatchewan, "incline somewhat toward *sennetti,* but are clearly . . . *hesperis*." Subsequently, Mitchell (1924:111), Todd (1947:406), and Godfrey (1950:42) considered *sennetti* to be the breeding race of that area. I recently examined seven of the specimens reported by Todd (*loc. cit.*). They are certainly referable to *sennetti* by reason of their abundant fine white vermiculations and light under parts but differ from examples of that race from North Dakota in having a darker ground color. In this latter respect they approach either *minor* or *hesperis*.

The inclusion of *sennetti* in the Utah check-list as a transient (Behle, 1944:76, and Woodbury, Cottam, and Sugden, 1949:17) is based on a specimen reported by Hayward (1940:94) from Provo, Utah County, collected on August 29, 1931, and another taken by Twomey (1942:402) near Jensen, Uintah County, on September 21, 1937. Both specimens are juvenal and neither is light enough dorsally to be confidently referred to *sennetti*. The one from Uintah County does not differ from many juveniles of *hesperis* from California and Nevada and is darker both ventrally and dorsally than some of them. The Provo bird is more like the present race but is matched by several examples of *hesperis* and may be merely a light specimen of that race. *Sennetti* eventually may be taken in Utah as it is a rather common transient in Colorado.

DISCUSSION

Booming Nighthawks in the western United States range altitudinally from tree line down to the lower limits of the Upper Sonoran Zone. They are replaced in the Lower Sonoran Zone by the Trilling Nighthawk (*Chordeiles acutipennis*). This altitudinal separation apparently breaks down in México but adequate data on the distributional relationships of the species in that region are not available. Within the wide vertical range occupied by *Chordeiles minor,* this species frequents open areas such as rocky slopes and ridges and burned-over patches and other clearings in stands of coniferous forest. It is especially abundant in the piñon-juniper forests of the southern Rocky Mountains and Great Basin (not true in California, see Miller, 1951:550) where, because of the spacing of trees and lack of shrubby undergrowth, large areas of bare ground are available. Sagebrush areas provide habitat of a similar type and flat, gravel-covered roofs of buildings also commonly are used for nesting.

The eggs are incubated in a shallow depression on the ground and the adult birds are inactive during the greater part of the day, either resting on the ground or perching on larger tree branches or similar structures. Concealment is provided by the color and mottled pattern of the dorsum which tends to resemble the background and by the barred under parts which serve to break up the body outline. This camouflaging effect of color and pattern is enhanced by a habit of "freezing" with head elevated and extended when alarmed. Geographic variation in color and pattern evidently is an adaptation to differences in the general aspect of soil and vegetation in various parts of the species' range. At the level of differentiation considered as of racial stature, wide ranging populations occupying the larger natural physiographic regions of western North America are recognizable. Examples are the pale buff population (*hesperis*) of the Great Basin and immediately adjacent areas where gray and light buff soils predominate, and the tawny population (*henryi*) of the deserts and mountains of the southwestern United States and northwestern México, where extensive areas of reddish soil occur. Within

each of the racial populations there is geographic variation of a lesser magnitude. Variation of this order, which has been described in the subspecies accounts, usually has the pattern of clinal changes in minor color characters.

Intrapopulation variability of pattern and color is correlated with the diversity of the ecological substrate. It is at a minimum in populations inhabiting regions of uniform soil color and vegetation type and it is greater in those which are distributed over a wide altitudinal range and consequently occupy several types of soil and vegetation. This relation is well illustrated within the range of the race *hesperis*, where the uniformity of birds from the Snake River Basin of southern Idaho contrasts with the greater variability of the populations of Nevada, California, and Utah. The first mentioned region is a flat semi-desert lying at about 4000 feet in elevation, where desert scrub, composed especially of sagebrush (*Artemisia*) and greasewood (*Sarcobatus*), is the dominant vegetation type. The soil is for the most part uniformly gray in color. Samples from this area show an unusual degree of uniformity of color and pattern. In Nevada this species occurs on the desert flats in the Upper Sonoran Zone and also extends upward in the numerous small mountain ranges into the boreal zones, thus occupying an altitudinal range from 4300 to 8600 feet, as indicated by data from specimens. This greater altitudinal range is associated with a greater degree of variability of characters as compared with the population of southern Idaho. In California records of summer occurrences are from 600 to 11,000 feet, although nesting seems confined to stands of coniferous trees in the upper part of this altitudinal range, largely in the Transition, Canadian, and Hudsonian zones, above about 4000 feet (Grinnell and Miller, 1944:210). The total range of variability of California birds is greater than that in Nevadan birds because of the common occurrence of dark individuals in various degrees approaching the northern race *minor*. Such extreme variants are uncommon in Nevadan samples and they are lacking in those from Idaho, but they regularly occur in populations of *hesperis* in western and central Montana and elsewhere in the Rocky Mountain region. In northeastern Utah the variational span of samples is equal to that of several of the racial types. In this region nighthawks have a vertical range of 5000 or more feet and encounter a variety of vegetation and soil types. Here they occur from the desert scrub flats at approximately 5000 feet in elevation upward through the piñon-juniper forest (about 5500 to 7000 feet), yellow pine forest (about 6000 to 8000 feet), and sagebrush stands (various elevations), sparingly to the Englemann spruce-alpine fir forest (to about 10,000 feet). Similarly great variation is seen in other populations inhabiting mountainous regions, notably those of central and western Colorado, Wyoming, and central southern Montana. In these regions, located as they are between areas of occurrence of several racial types, normal variability may be enhanced by gene flow from these adjacent differentiated populations.

In summary, the evidence would seem to indicate that in areas where nighthawks necessarily are restricted to one or a few habitats, selection acts to produce a correspondingly narrow range of variation, while more environmentally diverse regions are, in a sense, able to support a wider range of color and pattern types. Correlations between population and habitat variability also have been noted in *Pipilo fuscus* by Davis (1951:89) and in *Aphelocoma coerulescens* by Pitelka (1951:364).

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Museum of Vertebrate Zoology, Berkeley, California, September 4, 1953.

NOTES ON BREEDING ACTIVITIES AND ON GULAR SACS IN THE PINE GROSBEAK

By NORMAN R. FRENCH

The literature on breeding of Pine Grosbeaks (*Pinicola enucleator*) is scant, probably because the birds are seldom common even in their known breeding range. The writer was afforded an unusual opportunity in the summer of 1953 to witness the activities of these birds in the breeding season in the Uinta Mountains of northeastern Utah, and from June 10 until July 30, 1953, observations were made almost daily at 10,500 feet elevation approximately 20 miles east of Kamas, Summit County, Utah, and in adjoining portions of Duchesne and Wasatch counties. Rocky Mountain Pine Grosbeaks (*P. e. montana*) were regularly seen and twelve specimens were collected during this period. The two dominant trees in the region are Engelmann spruce, *Picea engelmanni*, and alpine fir, *Abies lasiocarpa*. In an extensive wet meadow *Carex* was dominant.

Upon first arrival at the area on June 10 there was a uniform cover of snow at least three feet deep. Local drifts were, of course, many times this depth. The first Pine Grosbeaks were seen on June 11 when a red male and a typical female were seen feeding with a mixed flock of birds composed of at least a dozen Red Crossbills (*Loxia curvirostra*), two Pine Siskins (*Spinus pinus*), a single Gray-headed Junco (*Junco caniceps*), and a single male Black Rosy Finch (*Leucosticte atrata*). These birds were feeding on the snow among scattered debris of the spruce trees. On June 15 a male grosbeak was collected and found to have enlarged testes (11 mm.). On June 20 another male had testes measuring 12 mm. On July 4 a nest was found containing two young. The young were last seen in the nest on July 14. Juveniles accompanied by adults were collected on June 30 and July 13. The bird taken on the former date was still being fed by a parent. After the latter date young birds were frequently seen.

From these records it appears that the breeding of Pine Grosbeaks in this region begins, on the average, by the end of the first week in June and the young are out of the nest after the first week in July. There is considerable variation, however, some individuals beginning prior to this time and some carrying over to a later date. Twomey (Ann. Carnegie Mus., 28, 1942:461) recorded Pine Grosbeaks in this area as being in postnuptial molt when he was there July 17 to 20, 1937. In two instances he saw adults feeding fully developed young.

The seeds of the Engelmann spruce seemed to be the main food for adult Pine Grosbeaks. In all specimens examined except one, spruce seeds were present. In one exception the esophagus was filled with tender new growth from the tips of spruce branches. Of three filled gular sacs examined, one contained 100 per cent spruce seeds, the second contained primarily spruce seeds with some new growth, and the third contained primarily seeds of *Silene acaulis* with some spruce seeds and insect parts. The young birds are probably on a diet of seeds by the middle of their nest life. On one occasion a pair of birds was seen eating the ovaries of glacier lilies, *Erythronium grandiflorum*.

Gular sacs in small passerine birds have been reported previously for only one species, *Leucosticte tephrocotis* (see Miller, Condor, 43, 1941:72-73). It was no surprise, then, when similar structures were found in the Black Rosy Finch. However, it was found that the Pine Grosbeak also makes use of such a special food-carrying device. This first came to my attention on June 30 when a male was collected. This bird had the throat very much distended with food. When skinning the specimen it was found that the structure was the same as that in the *Leucosticte*. Comparison of sketches from my field notes and of preserved material with Miller's figure (*op. cit.*) show that the structure is identical in the two genera. When fully distended in the Pine Grosbeak the sacs extend far

back under the skull. The opening of each sac extends for a full centimeter or more along the side of the tongue. As in *Leucosticte* it is found in both sexes and only for a brief time during the breeding season when the birds are feeding young. Examination of a specimen taken at an earlier date, June 20, and preserved in formalin disclosed that this bird, too, had gular sacs but they were apparently not in use at the time. They were 2 or 3 mm. in depth and extended back only as far as the posterior margin of the glottis. The tissue forming the pouches was highly folded, however, and undoubtedly would have extended into a sizable structure. It is believed that this specimen was breeding but was not yet feeding young. Examination of the preserved carcass of another specimen taken on June 15 shows unmistakable indications of gular sacs, perhaps somewhat less

Fig. 1. Pine Grosbeak territories showing location of nest (x). The approximate mean diameter of territory number 1 was 1200 feet.

developed than the last. This bird when collected was accompanied by a female. A *Leucosticte* taken in winter shows no indication of the sacs. It is believed that there is a proliferation of the tissue of the floor of the mouth beginning just prior to the breeding season, perhaps concomitant with the enlargement of the gonads, and under similar control.

On July 4 my attention was drawn to a wooded island in a wet meadow by a pair of grosbeaks. The female was singing and doing a great deal of fly-catching. The insects it caught could be plainly seen in the late afternoon sunlight. Only once was the male observed carrying on this activity. The nest containing two young was located the following day. It was situated in a spruce tree about twenty feet from the ground near the end of a sloping branch. It was a coarse structure of twigs, well concealed from the sides and top by foliage but was visible from below.

The nest was observed on five mornings between the hours of 5:00 and 8:00 a.m. It seemed unusual to see the adults constantly traveling together. Both birds would approach the nest at the same time with their throats noticeably distended due to filled gular sacs. One bird would arrive at one side of the nest and the second would perch on the opposite side. The first bird might be either sex and might choose either route. Generally, the first to arrive was the first to feed the young but even this was not constant. The second bird would sit patiently until the first had completed the feeding process. After feeding, the first bird might remove a fecal sac from the nest and fly to a nearby tree or wait at varying distances from the nest or at the nest itself while its mate fed the young. After this they would depart together, one or both carrying fecal sacs. They left the "island" together, except on three occasions when the female stayed to brood. The

departure frequently involved a chasing ceremony in which one bird would dive at the other on its perch, forcing it to fly, and would continue to chase it across the meadow. Either sex might be the chaser.

Their absences from the nest averaged 25 minutes (extremes, 20 and 30 minutes). Approximately three minutes were required at the nest for both birds to feed the young. Their leisurely and quiet attitude was impressive. Even the young birds could seldom be heard. On only two occasions were sounds from them heard by me at a distance of fifteen feet from the nest.

After the young had left the nest the birds gathered in small flocks, possibly family groups, which persisted as long as this area was under observation. They were frequently seen feeding together on the ground or upon the new growth of the spruce branches.

A bird believed to be the male of the nest described was seen on numerous occasions. Prior to the discovery of the nest it was seen singing or sometimes feeding in company with the female. On the basis of these observations the territory was outlined (fig. 1, number 1). The approximate territories of three other pairs are partially shown and are numbered. These territories (2, 3 and 4) were defined on the basis of pairs seen repeatedly or adults with young seen or collected. There may have been some overlap between territories 1, 2 and 3 but there were no observations to indicate this. Territory 4 may have extended more in the direction of territory 1.

On two occasions strange Pine Grosbeaks were tolerated by the nesting pair. Once a foreign pair was feeding with the resident pair in a small spruce less than thirty yards from the nest tree. At another time the resident pair feeding in the meadow about fifty yards from the nest tree was joined by a strange male. This bird was tolerated for several minutes until it flew to within three feet of the resident female, upon which it was driven away by the resident male. Both of these occurrences were rather late in the nest history, the territorial drive probably having waned by that time.

Of the six males collected two showed no red in the plumage. One of these was taken June 30 while feeding a juvenal bird. The left testis measured 9 mm. The second, taken on the same date, had a left testis which measured 7 mm. in length. Two males taken show some yellow in the plumage. In the first of these the yellow is primarily on the sides of the breast and the upper tail coverts. In the second bird small yellow areas are found in front of and behind each eye as well as on the upper tail coverts. The symmetry of this distribution suggests the possibility of diet during the period of the molt as a contributing factor. Twomey (*loc. cit.*) suggests the loss of feather barbules as the cause.

A pair of Gray-headed Juncos nested near the base of the same tree in which the grosbeaks were nesting. The grosbeaks sometimes alighted low in the tree and worked up to their nest. The juncos invariably came into the tree and worked down to their nest. As a result the paths of the birds sometimes crossed. When a junco was on a perch and one of the grosbeaks came toward it the junco immediately flew, usually to a lower perch in the tree. Generally, the matter ended at this point. At times, however, the grosbeak continued to pursue the smaller bird. This may have been due to my presence at the base of the tree and hence was not typical behavior. Under similar conditions the same attitudes were taken, though less frequently, when the grosbeaks met White-crowned Sparrows (*Zonotrichia leucophrys*) which nested ten yards from the base of the nest tree. When a large hawk flew over some distance away both grosbeaks flew to the top of a tree and sang. One bird that was not tolerated in the vicinity was the Canada Jay (*Perisoreus canadensis*). When one of these appeared both male and female attacked it violently. The male once gave fierce chase to a Red Squirrel (*Tamiasciurus hudsonicus*) which was in a dead tree near the nest tree. The bird drove the intruder around the top of the tree and ceased chasing only when the squirrel had returned to the ground.

Division of Biology, University of Utah, Salt Lake City, Utah, October 18, 1953.

FERDINAND DEPPE'S TRAVELS IN MEXICO, 1824–1829

By ERWIN STRESEMANN

NARRATIVE OF DEPPE'S JOURNEYS

The establishment of Mexican independence, which dates from 1821, made it possible for Europeans of any nationality to settle in México and to send home whatever they wanted. As early as 1823 William Bullock went to México with the aim of acquiring abandoned gold and silver mines. Bullock formerly was a London goldsmith and was well known for being the owner of the London Museum which was dissolved by auction in 1819. When he returned to London at the end of 1823 he brought back with him all sorts of Mexican curiosities which served for a public show, called "New Mexico," in his "Egyptian Hall." Included among these curiosities were a few birds mounted on artificial palms and cacti and picturesquely arranged around some Mexican mammals.

In Germany the news of mysterious México having become accessible even to the ordinary traveller excited the curiosity of a wealthy nobleman, the Count von Sack, "Zweiter Ober-Jägermeister" and chamberlain to the King of Prussia. He had recently returned from a voyage to Egypt and Cyprus where he made a small collection of birds (Stresemann, Ibis, 1953:549), and he at once felt inclined to visit México, provided that there was a collecting naturalist of good reputation to go with him. A gardener, appointed to the Royal Gardens, by the name of Ferdinand Deppe, was recommended for this task by Professor Hinrich Lichtenstein, Director of the Zoological Museum of Berlin University. Deppe was an intelligent and energetic young man born in 1794. For a long while his connection with the Zoological Museum had been intimate, the more so as his oldest brother Wilhelm was accountant of that institution. On Count von Sack's advice Deppe gave up his job in 1821 and prepared for the voyage to México. He trained himself in skinning birds and mammals, a technique which he soon mastered to great perfection. Besides, he studied books on the zoology, botany, and geography of South America, took lessons in drawing and painting, and acquired English and Spanish. However, the wayward Count remained undecided for three more years, and it was only due to the insistence of Deppe that the plan to go to México was at last carried out in 1824.

The party, increased by the Count's domestic, arrived in London on August 23, 1824, where Deppe visited, besides the British Museum (the zoological section of which he judged far inferior to the Berlin Museum), Mr. Bullock's Mexican Show and Mr. Leadbeater's shop where his eyes were caught by some fine Mexican birds like "*Ibis mexicana*" and hummingbirds.

On October 8 they sailed from Falmouth on board a British ship via Barbados to Jamaica. From there they took another vessel bound for Alvarado, Veracruz, arriving there in mid-December, 1824, soon after the Count's footman had succumbed on board to an infection with yellow fever.

Two years later, in January, 1827, Deppe again left México after having travelled via Mexico City to Oaxaca and Tehuantepec and back via Oaxaca to Alvarado. He and William Bullock's son, who joined him on the voyage from Mexico City to Tehuantepec, are the first naturalists who ever collected birds in México for scientific purposes. The results of their efforts, studied by Swainson, Wagler, and many subsequent systematists, have formed the foundation of Mexican ornithology.

The following itinerary has been compiled from Deppe's letters kept in the archives of the Zoological Museum in Berlin and from the entries in Lichtenstein's lists of acquisitions.

From December 25, 1824, to January, 1825, an excursion was made from Alvarado to the swamps and lagunas near Tlacotalpán in Veracruz. In January he went from Alvarado to Jalapa, Veracruz, and in February from Jalapa to México City.

In April an excursion was made from México City to Temascaltepec, state of México, where Deppe made the acquaintance of Mr. Bullock, Jr., who, like his father, took to the hobby of collecting birds and was an excellent shot. He came over with his father in 1823 and lived in Temascaltepec as agent of a British mining company. Deppe went back to México City on May 10. He stayed in and near México City from May 11 to the end of May.

In June and July a trip was made to Chico and Toluca in the state of México, including a stay at Tlalpaxahua where *Diglossa baritula* Wagler (*"Campylops humilis"* Lichtenstein MS) was collected, and another stay at Cimapán. On the slopes of Volcán Toluca, *Sitta carolinensis mexicana* Nelson and Palmer was taken "on *Pinus*."

On August 26, Deppe, joined by Bullock, Jr., started for a long voyage to Tehuantepec. Taking the route via Puebla and Tehuacán, Puebla, they reached the city of Oaxaca by September 6. Extensive field work was done in the vicinity; the collection includes a skin of *Eremophila alpestris oaxacae* Nelson "from the mountain range near Oaxaca," and one of *Parus sclateri* Kleinschmidt from Uchilacqua. On one of these trips they reached Villa Alta, "37 Legoas" from Oaxaca on September 22.

On October 22 Deppe and Bullock continued their journeys, and six days later they reached Tehuantepec via San Bartolo. Early in November they proceeded to the shore of the Pacific (San Matteo, Santa Maria al Mar) and they were back in the city of Oaxaca by the 22nd of that month.

On December 5, Bullock left for Mexico City to meet his father there. Deppe left Oaxaca the next day and chose a direct route to Alvarado which proved very difficult. On December 18, he crossed the Cordillera Costal at a place called Valle Real, Veracruz, clad with luxuriant forest in which, besides many fine new birds, a troup of monkeys (*Ateles vellerosus* Gray) was found. He was back in Alvarado on December 22.

Early in January of 1826 Deppe paid another, and this time extensive, visit to Valle Real. From there he returned to Alvarado in March and proceeded via Santuario to the City of Vera Cruz which was reached by March 23. After a short stay there he left for México City at the end of March. The time from April 13 to July 16 was devoted to excursions to the surroundings of México City, including a ride to Chico and Ixmiquilpec.

On July 17 Deppe left the capital to visit his friend Bullock, Jr., at his place at Rincon de Temascaltepec. He crossed the range of Las Cruces and proceeded via Tenancingo and Sacualpán, México. His stay in Temascaltepec lasted from July 28 to late September, with excursions to Real (de) Arriba, México, and to Jantepeque and Cuernavaca in Morelos. Near Real Arriba, *Parus wollweberi* increased the collection in August.

In August in Temascaltepec Deppe met William Bullock, who had made a business voyage to México in company of his wife and daughter. After his return to London in 1823 the senior Bullock had founded a British mining company of which he was then the director. On going back to London in September of 1826, William Bullock took with him many bird skins collected at various places which at once were studied, and partly bought, by his friend William Swainson. The localities of some of the new species which Bullock, Jr., had collected when crossing the state of Oaxaca in 1825 were wrongly given as "*Temascaltepec*" in Swainson's descriptions of 1827. William Bullock remembered Lichtenstein very well, as he had been a prominent figure at the auction of his "London Museum," and Bullock wished to be remembered to him.

At the end of September, Deppe went back to the Capital Federal and prepared for a quick departure. He reached Jalapa by October 26 and embarked at Veracruz at the

end of January for Hamburg on the German vessel "Anna Maria." On April 9, 1827, after almost three years of absence, he was welcomed back in Berlin.

Since the landing at Alvarado in December, 1824, there has been no mention of the Count von Sack in this short review of the itinerary. The Count seems to have been a very queer and whimsical person. No longer disposed to support his employer's bad manners, Deppe parted with him in May of 1825 and carried out all the rest of the expedition on his own risk. The Count returned to the coast in the autumn of 1825, sailed back to Jamaica, and reappeared in the summer of 1826 in Berlin, where three years later he died.

In the years 1825 and 1826, Deppe had made, all by himself, 958 bird skins, representing about 315 species; besides, he had collected a number of mammals, a quantity of reptiles, amphibians, fishes, snails, and thousands of insects. Nor had botany been neglected by this indefatigable naturalist. All his zoological material was bought by the Zoological Museum of Berlin. But in vain had he hoped to be rewarded with a post at one of the scientific institutions of the Prussian capital. This induced him to return to his beloved México once more, this time in company of a dear friend, the botanist Dr. Wilhelm Schiede. They expected to make their living in México by selling zoological and botanical specimens to European museums and dealers. In July of 1828 they settled down in Jalapa, whence they made distant excursions to various places, all within or near to the boundary of the state of Veracruz; among others were the Pico de Orizaba, which they ascended almost to the summit, Misantla, Papantla, Veracruz, and the Laguna Huetulacán, west of the Cofre de Perote. But they were soon disappointed. Lichtenstein was no longer able to buy quantities of Mexican material at reasonable prices, and although part of the material which the two friends had collected up to May 7, 1829, had been acquired by the museums of Berlin and Vienna, the financial result of their efforts was far from what they had expected. In order to save his brother from distress, Wilhelm Deppe decided to distribute in print a "Preis-Verzeichniss der Säugethiere, Vögel, Amphibien, Fische und Krebse, welche von den Herren Deppe und Schiede in Mexico gesammelt worden, und bei dem unterzeichneten Bevollmächtigten in Berlin gegen baare Zahlung in Preuss. Courant zu erhalten sind." This was signed "Berlin am 1ten September 1830. W. Deppe." [The reprint of this in the Journal für Ornithologie, 1863, pages 54-60, was headed by the misleading title "Lichtensteins's Preis-Verzeichniss mexicanischer Vögel," etc.]. The success of this price list must have been very discouraging. Ferdinand Deppe and Schiede were forced to give up this kind of business in 1830. The latter died soon afterward. Deppe became a commission agent of merchants that were located at Acapulco and Monterey, California, and travelled through the western and northern states of México without ever touching the collecting gun. In 1836 he was tricked out of all he had earned and decided to sail home to Germany once more. On his way back he collected a number of interesting birds near Monterey, California, and on the island of Oahu, Hawaii. These proofs of Deppe's renewed activity will be discussed in another article. Back to Berlin in 1838 the unfortunate Deppe was again denied an official appointment. He died in oblivion about 1860.

THE SCIENTIFIC RESULTS

Ferdinand Deppe was to share the fate of all the zealous men who, during the era of Lichtenstein, collected quantities of birds overseas for the benefit of the Berlin Museum. Like that of his contemporaries Hemprich, Ehrenberg, Friedrich Sellow, and Ludwig Krebs, Deppe's important material never was properly studied by Lichtenstein. Lichtenstein gave every species, or what he judged to be a species, a name, it is true, but this was done without consulting the recent English and French literature. His only aim

was to give the specimens in question a distinguishing mark for his personal needs. These names were used in Lichtenstein's registers and reappeared on the labels of the mounted specimens, but they only exceptionally were publishd by himself in connection with a scientific description. Of the many dozens of striking novelties contained in Deppe's Mexican collections, Lichtenstein described and figured just one, *Hylomanes momotula*, and this only 14 years afterward, in 1839. The critical examination of the material was left to learned visitors at the Berlin Museum, and finally to Cabanis. Johann Wagler (1828), John Gould (1833, 1843), C. L. Brehm (1851), C. L. Bonaparte (1850), Reichenbach, H. Schlegel, and P. L. Sclater (1868) studied some of Deppe's Mexican birds when visiting Berlin, and by publishing their descriptions of new species have saved the types for the Berlin Museum.

Some of these descriptions have not been provided with an exact locality. The recent discovery of Lichtenstein's detailed registers written immediately after the arrival of Deppe's collections and mostly supplemented by a copy of the original label's text, enables me to supply these locations in the following list. Only the valid names are given, not those which already have become synonyms. All specimens listed are types (holotypes or cotypes, respectively).

Dendrortyx barbatus Gould, 1846—"Jalapa" [,Veracruz], 1828.

Odontophorus lineolatus Gould, 1850—Papantla [,Veracruz], 1829.

This name has been applied wrongly by Hellmayr and Conover (Cat. Birds Am. 1, 1, 1942:282) to the race (still anonymous) inhabiting Oaxaca. It therefore turns out to be a synonym of *Dactylortyx thoracicus thoracicus* (Gambel, 1848) named from Jalapa.

Ortalis vetula poliocephala (Wagler, 1830)—Real Arriba [,México], August, 1826.

Burhinus bistriatus (Wagler, 1829)—San Matteo [,Oaxaca], November, 1825.

Asturina nitida plagiata Schlegel, 1862—Veracruz [,Veracruz], 1829.

Ciccaba virgata squamulata (Bonaparte, 1850)—Los Cues [,Puebla], September 1, 1825 (transferred to Leyden Museum).

Trogon citreolus citreolus Gould, 1835—Tehuantepec [,Oaxaca], November, 1825.

Trogon citreolus melanocephalus Gould, 1838—types or cotypes: Alvarado [,Veracruz], December, 1824, January, 1826; Valle Real [,Veracruz], February, 1826.

Trogon violaceus braccatus (Cabanis and Heine, 1863)—Valle Real [,Veracruz], December, 1825, February, 1826.

Aulacorhynchus prasinus Gould, 1834—Valle Real [,Veracruz], December, 1825; Pico de Orizaba (?), 1828.

Veniliornis oleagineus Reichenbach, 1854—Papantla [,Veracruz], 1829.

Dendrocopos scalaris (Wagler, 1829)—Jalapa [,Veracruz], January, 1825, lectotype; Tehuacán [,Puebla], August 30, 1925.

Phloeoceastes guatemalensis regius (Reichenbach, 1854)—Papantla [,Veracruz], 1829.

Centurus polygrammus Cabanis, 1862—San Bartolo [,Oaxaca], October, 1825.

Centurus hypopolius (Wagler, 1829)—Tehuacán [,Puebla], August 30, 1825.

Celeus castaneus (Wagler, 1829)—Valle Real [,Veracruz], December, 1825, and February, 1826.

Myiochanes pertinax (Cabanis and Heine, 1859)—Jalapa [,Veracruz], 1828 (transferred to Museum Heineanum).

Empidonax fulvifrons rubicundus Cabanis and Heine, 1859—México City, March, 1825; Real Arriba [,México], August, 1826; Jalapa [,Veracruz], 1828, lectotype.

Lanius ludovicianus mexicanus Brehm, 1854—Jantepeque [,Morelos], September, 1826.

Corvus corax sinuatus Wagler, 1828—No special locality mentioned.

Psilorhinus morio (Wagler, 1829)—Alvarado [,Veracruz], December, 1824, and January, 1825; Jalapa [,Veracruz], January, 1825, lectotype.

Thryothorus pleurostictus nisorius Sclater, 1869—Real Arriba [,México], September, 1826.

Tangavius aeneus (Wagler, 1829)—*Oaxaca [,Oaxaca], October, 1825, lectoype; Laguna Huetulacan [,Veracruz], 1828.

Agelaius phoeniceus gubernator (Wagler, 1832)—México City, March, 1825.
Icterus gularis (Wagler, 1829)—Tehuantepec [,Oaxaca], November, 1825.
Icterus mesomelas (Wagler, 1829)—Chacaltianges [,Veracruz], March, 1826.
Icterus pectoralis (Wagler, 1829)—Totulapa [,Oaxaca], October, 1825.
Icterus pustulatus (Wagler, 1829)—San Matteo [,Oaxaca], November, 1825, lectotype; Cuernavaca [,Morelos], September, 1826; Huantepec [,Oaxaca], September, 1825.
Euphagus cyanocephalus (Wagler, 1829)—México City, March, 1825; *Temascaltepec [,México], April, 1825, lectotype; Oaxaca [,Oaxaca], October, 1825.
Cyanocompsa parellina (Bonaparte, 1850)—Alvarado [,Veracruz], January, 1826.
Sporophila torqueola (Bonaparte, 1850)—Mexico City, March, 1825.
Melozone kieneri rubricatum (Cabanis, 1851)—Real Arriba [,México], August, 1826.
Aimophila humeralis (Cabanis, 1851)—Tehotepec [,Puebla], September, 1825; Cuernavaca [Morelos], September, 1826, lectotype (transferred to Museum Heineanum).
Euthlypis lachrymosa (Bonaparte, 1850)—Laguna Huetulacan [,Veracruz], 1828.
Vermivora superciliosa mexicana (Bonaparte, 1850)—Chico [,México], June, 1825; Real Arriba [,México], August, 1826, lectotype.
Icteria virens auricollis Bonaparte, 1850—Cimapán [,Mexico], July, 1825; Mexico City, June, 1826, lectotype; Tehuantepec [,México], November, 1825.
Catharus melpomene (Cabanis, 1851)—Temascaltepec [,México], April, 1825; Chico [,México], July, 1825; Real Arriba [,México], August-September, 1826; Jalapa [,Veracruz], 1828, lectotype.
Turdus assimilis Cabanis, 1851—"Jalapa" [,Veracruz], 1828 (transferred to Museum Heineanum).
Polioptila caerulea mexicana (Bonaparte, 1850)—Oaxaca [,Oaxaca], October, 1825.
Certhia americana alticola G. S. Miller, 1895 (new name for *Certhia mexicana* Gloger, 1834, not Gmelin, 1788)—Mountains near Oaxaca [,Oaxaca], September, 1825.

An additional number of descriptions based on Deppe's collections has generally been ascribed to Lichtenstein, namely, those appearing in the "Preis-Verzeichniss" of 1830 (*vide supra*). This, however, means doing injustice to Lichtenstein. Those naive allusions to color and shape are not his work, but that of Wilhelm Deppe who himself signs responsibility for the list. He simply made use of the manuscript names given to the respective species by Lichtenstein in the Berlin Museum. Technically not the Museum's specimens, but those offered for sale in the "Preis-Verzeichniss" will have to be considered types of the new species. They all were collected in the state of Veracruz (or, as far as the Pico de Orizaba is concerned, in that of Puebla) which thus automatically becomes their type locality. The cotypes mentioned had been selected by Lichtenstein from the Deppe and Schiede collection before W. Deppe drew up his Preis-Verzeichniss.

In the following list the necessary nomenclatural changes are given. Numbers are those of W. Deppe's price list. The nomenclature is in accord with Hellmayr's and Peters' works.

17. "*Cuculus viaticus* Lichtenst. Bunt gesprenkelt wie der Tannenhäher, die Federn grün mit weissen Rändern, sehr langer Schwanz" is the earliest name of the Mexican Roadrunner, antedating *Geococcyx variegata* Wagler, 1831, and *Cuculus velox* Wagner, 1836. According to F. Deppe's letter dated Mexico, May 18, 1825, this species was first shown to him by Mr. Bullock, Jr. It was known in Temascaltepec by the name of Corre Camino, but in Mexico City not even Señores Cervantes and de la Llave, the only men interested in natural history, had even seen it. Deppe sent the Roadrunner's nest with two eggs to Berlin in 1825 and got additional specimens at Actopán in June, 1825, and at Tehuantepec in November, 1825. The name of *Geococcyx velox* (Wagner) has to be replaced by *Geococcyx viaticus* (W. Deppe), unless it will be considered a nomen conservandum by the International Commission of Zoological Nomenclature.
26. *Amazilia beryllina* (Lichtenstein) becomes *Amazilia beryllina* (W. Deppe). Type sold. Cotype, from "Jalapa," 1828, in Zoological Museum, Berlin.

27. "*Trochilus verticalis* Lichtenst." becomes *Amazilia verticalis* (W. Deppe), replacing *Amazilia violiceps* Gould, 1859, unless the former will be considered a nomen conservandum. Type sold. Cotype, from "Jalapa," 1828, in Zoological Museum Berlin.
29. "*Trochilus cuculliger* Lichtenst." is a synonym of *Basilinna leucotis* (Vieillot, 1818).
32. *Campylopterus curvipennis* (Lichtenstein) becomes *Campylopterus curvipennis* (W. Deppe). Type sold. Cotype, from "Jalapa," 1828, in Zoological Museum Berlin. Deppe's field note, Jalapa, November, 1828, is as folows: "Zeichnet sich durch sein Geschrei aus, das sehr laut ist und ungefähr wie die Stimme von *Penelope superciliaris* klingt. Er lebt nur in ganz dichtem Gebüsch wo man immer mehrere beisammen findet. Sie sitzen viel häufiger auf Zweigen als andere Kolibris. In der Luftröhre befindet sich eine eigentümliche knorplige Bildung, die bei keiner der übrigen Kolibri Arten vorkommt. Zur näheren Untersuchung folgt ein Körper in Branntwein."
33. *Campylopterus hemileucurus* (Lichtenstein) becomes *Campylopterus hemileucurus* (W. Deppe). Type sold. Cotype, from "Jalapa," 1828, in Zoological Museum Berlin.
34. "*Trochilus coruscus* Lichtenst." is a synonym of *Calothorax lucifer* (Swainson, 1827).
38. *Amblycercus holosericeus* (Lichtenstein) becomes *Amblycercus holosericeus* (W. Deppe). Type sold. Cotype, from Alvarado [Veracruz], in Zoological Museum Berlin.
42. *Dives dives* (Lichtenstein) becomes *Dives dives* (W. Deppe). Type sold. Cotype, from Valle Real [Veracruz], in Zoological Museum Berlin.
59. "*Alauda glacialis* Mas (*alpestris* affinis)" is a synonym of *Eremophila alpestris chrysolaema* (Wagler).
66. *Saltator caerulescens grandis* (Lichtenstein) becomes *Saltator caerulescens grandis* (W. Deppe). Type sold. Cotype, from Jalapa, 1828, in Zoological Museum Berlin.
70. *Thraupis abbas* (Lichtenstein) becomes *Thraupis abbas* (W. Deppe). Type sold. Cotype, from Jalapa, 1828, in Zoological Museum Berlin.
71. "*Tanagra rutila* Lichtenst. Mas. Oberhalb braungrau, unterhalb ebenso, heller." This meagre description was taken from a specimen in the Deppe and Schiede collection, which has been sold. Consequently, *Tanagra rutila* W. Deppe becomes a synonym of *Pipilo fuscus* Swainson, 1827, whereas *Pipilo albicollis* Sclater is the correct name of the species inhabiting the state of Oaxaca which has been called *Pipilo rutilus* (Lichtenstein) by Hellmayr (Cat. Birds Am., part 11, 1938: 468). The manuscript name of *Tanagra rutila* was first given by Lichtenstein to two specimens, collected, respectively, at Cimapán [,México], in July, 1825, and at Oaxaca [,Oaxaca], in September, 1825, and later on to three specimens from Temascaltepec, August and September, 1826, none of which can be considered the type of W. Deppe's description. It now proves to have been a technical mistake to select the Oaxaca specimen as the type of *Tanagra rutila*.
72. *Rhodothraupis celaeno* (Lichtenstein) becomes *Rhodothraupis celaeno* (W. Deppe). Type sold. Cotype, from Papantla, 1829, in Zoological Museum Berlin.
78. *Basileuterus culicivorus* (Lichtenstein) becomes *Basileuterus culicivorus* (W. Deppe). Type sold. Cotype, from Jalapa, 1828, in Zoological Museum Berlin.
81. "*Troglodytes mexicanus* Lichtenstein" becomes *Thryomanes bewickii mexicanus* (W. Deppe), antedating *Thryomanes bewickii murinus* (Hartlaub, 1852), see Meise (Jour. für Ornith. 93, 1952:178). Type, from the State of Veravruz, sold.
82. "*Troglodytes latifasciatus* Lichtenstein" becomes *Salpinctes obsoletus latifasciatus* (W. Deppe), antedating *Salpinctes obsoletus notius* Ridgway 1903, see Meise (*loc. cit.*). Type sold.
107. *Nuttallornis mesoleucus* (Lichtenstein) becomes *Nuttallornis mesoleucus* (W. Deppe).
113. *Buteogallus anthracinus* (Lichtenstein) becomes *Buteogallus anthracinus* (W. Deppe).

The "Preis-Verzeichniss" is apparently not the only publication specially devoted to specimens which were collected by Deppe and Schiede. I take it for certain that the Mexican species described by Wagler in Oken's "Isis" for 1830 and 1831 belong to the same group. In 1830 the Munich Museum was presented with a case containing Mexican mammals and birds. The donor was a Bavarian by the name of Reerl (or Keerl), who had lived in México for several years. The novelties and all the additional species listed by Wagler had been represented in Deppe's collection of 1825–1826, or in the Deppe and Schiede collections which were sent to Berlin in 1828 and 1829. Three of Wagler's

new species are birds of high altitude. According to the documents preserved in the archives of the Berlin Museum, Deppe and Schiede ascended the Pico de Orizaba in 1828. Soon afterward, in 1829, they were in great financial trouble. It seems therefore most likely that the two friends sold part of their collection to a German who was about to sail home again from Verucruz. If this theory is accepted, the types of the following species must have been obtained in the state of Veracruz, or on the Pico de Orizaba (Puebla).

From High Altitude

Atlapetes pileatus Wagner, 1831.
Junco phaeonotus Wagler, 1831.
Eremophila alpestris chrysolaema (Wagler, 1831), [see Preis-Verzeichniss, 1830, Nr. 59].

From the Lowlands

Geococcyx variegata Wagler, 1831 = *Geococcyx viaticus* (W. Deppe, 1830), [see Preis-Verzeichniss, Nr. 17].
Columba flavirostris Wagler, 1831.
Jacana spinosa gymnostoma (Wagler, 1831).
Larus pipixcan Wagler, 1831.
Penelope purpurascens Wagler, 1830.
Ortalis vetula (Wagler, 1830), [see Preis-Verzeichniss, Nr. 122].

The five Mexican birds which were discovered by Wagler in the Würzburg Museum ["Dr. Petz leg."] and described by him in 1832—*Diglossa baritula, Glaucidium gnoma, Otus trichopsis, "Odontophorus meleagris"* = *Cyrtonyx montezumae* (Vigors) and "*Callipepla strenua*" = *Callipepla squamata* (Vigors)—certainly did not pass through the hands of Deppe and Schiede. They apparently were collected in the Valley of Mexico (by Dr. Petz himself?).

Zoological Museum Berlin, May 12, 1953.

NEST TEMPERATURES AND ATTENTIVENESS IN THE ANNA HUMMINGBIRD

By THOMAS R. HOWELL and WILLIAM R. DAWSON

Recent investigations of the energy metabolism of hummingbirds (Pearson, 1950) have documented quantitatively the existence of torpidity in the family Trochilidae. Should this phenomenon occur in nesting females, it would have considerable effect on incubation and brooding temperatures and so would be important at a critical stage in the life history of the young. The lack of data on nesting temperatures for any trochilid prompted us to take advantage of an opportunity to study the Anna Hummingbird (*Calypte anna*), one of the species for which metabolic data are available.

MATERIALS AND METHODS

In April, 1952, Dr. Waldo H. Furgason of the Department of Zoology, University of California, Los Angeles, informed us that a female Anna Hummingbird was building a nest outside a window of his residence in West Los Angeles. The location of the nest made possible continuous observation and use of a temperature recording instrument without disturbing the female. Nest temperatures were measured with a thermocouple of 30-gauge, copper-constantan duplex wire inserted through the bottom of the nest so that the junction lay between the two eggs which the nest contained. Air temperatures were measured with another thermocouple placed near the nest, which was located on the north side of the house and never received direct sunlight. A stepping switch driven by a synchronous electric motor, in conjunction with a Brown Electronik Recording Potentiometer, allowed us to measure and record the temperature of the thermocouple inside the nest for 17 minutes and the temperature of the thermocouple outside the nest for 3 minutes out of every 20. Thus, it was possible to obtain essentially continuous records of air and nest temperatures over long periods of time. The position of the thermocouple in the nest was unchanged at the termination of the study, despite the movements of the parent and of the young.

We are grateful to Dr. Waldo H. Furgason for calling our attention to this nest and for his kindness in allowing us full use of his residence during the study period.

RESULTS

Temperatures were recorded from 1 to 8 p.m. on April 28, from 10 a.m. on April 29 to 12 noon on May 1 (fig. 1), and from 5 p.m. on May 1 to 5 p.m. on May 4, 1952. The eggs hatched on May 3. Records were again obtained in the period from 11 a.m. on May 16 to 5 p.m. on May 18, 1952, at which time the young were in their 13th to 15th days (fig. 2).

Departures of the female from the nest in the period before and shortly after the eggs were hatched resulted in a rapid decline in nest temperature, whereas her returns resulted in a rapid rise. These events made it possible to determine from the temperature record the number and duration of inattentive periods. These inattentive periods are tabulated in table 1. Inattentive periods of the female were generally less than 20 minutes, and the longest was less than 40 minutes. Since the thermocouple in the nest was between the eggs, and infrequently in contact with the skin of the parent bird, its temterature was usually somewhat below skin temperature. This thermocouple, therefore, measured the temperature at the outer surface of the eggs, in which there was continuous slight variation. Consequently, the points plotted in figure 1 represent the approximate average temperature in the nest during each hour. The extent of the tempera-

ture variation during any given interval provides a rough index of the activity of the female. The maxima usually indicate that the skin of the parent came close to or in contact with the thermocouple as she shifted around on the nest, and the minima indicate absence of the parent. In general, the lower the minimum temperature, the longer was the inattentive period. Minute to minute variation in air temperature was very slight during the study periods except when occasional gusts of wind caused sudden changes of several degrees.

Table 1

Number and Duration in Minutes of Inattentive Periods

Time (to nearest hour)	April 28		April 29		April 30		May 1		May 2		May 3		May 4	
	No.	Min.	No.	Min.	No.	Min.	No.	Min.	No.	Min.	No.	Min.	No.	Min.
4–5 a.m.					3	36.5	2	7.1	2	4.1	2	5.3	4	14.2
5–6					7	10.0	5	13.0	7	14.7	3	3.7	5	5.9
6–7					7	8.2	8	10.0	5	12.3	3	5.0	4	13.0
7–8					7	11.7	6	10.0	3	16.4	3	6.5	3	10.6
8–9					3	12.3	4	29.4	1	3.55	5	11.7	3	13.5
9–10					3	9.4	2	5.3	0	0	2	4.7	1	4.7
10–11			3	4.7	3	7.1	1	2.35	2	6.45	1	1.76	2	13.0
11–12			3	12.3	8	13.0	2	8.8	5	10.0	4	13.0	3	18.2
12–1 p.m.			1	10.6	7	8.8			2	11.2	0	0	2	11.2
1–2	2	1.76	2	2.95	4	10.0			2	10.6	1*	8.2	3	13.0
2–3	4	5.3	3	11.2	3	18.2			2	9.4	3†	16.4	0	0
3–4	4	4.1	2	2.95	3	9.4			1	8.8	3	13.5	3	13.5
4–5	4	9.4	2	6.5	3	9.4			2	11.7	4	15.2	3	11.0
5–6	3	8.8	2	8.8	4	8.8	4	10.6	2	20.0	5	9.4		
6–7	0	0	0	0	0	0	0	0			1	2.95		
Total time recorded (minutes)	295		457		843		488		793		838		725	
Per cent inattentive	10.0		13.1		20.5		19.8		17.6		14.0		20.1	

* One newly-hatched young was seen at 1:45 p.m.
† The second egg was hatched at 2:30 p.m.

The nest temperatures from May 16 to May 18 are presented in figure 2. By the time the young were 12 days old they filled the nest and the parent no longer was near the thermocouple during her visits. Therefore, data on attentive and inattentive periods at this time are lacking, and the temperature fluctuations indicate activity of the young and not the parent. During this period, the young were not brooded day or night by the female.

There was no evidence of torpidity in the parent bird while incubating. As shown in figure 1, nest temperature always remained about 10°C. above air temperature at night. In fact, on April 30 nest temperature rose between 6 and 10 p.m. (from 27 to 29°C.) while air temperature fell (from 18 to 13°C.). The temperatures to which the female was exposed were lower than some at which Pearson (1950) observed torpidity to occur in a male Anna Hummingbird. However, there was no indication that the body temperature of the female closely approached the environmental level at any time. Nighttime observations during June, 1953, of another nest of an Anna Hummingbird also failed to reveal any signs of torpidity in the incubating female, even though air temperatures were again as low as some at which torpidity has been reported.

In the first few days after hatching, the nestlings exhibited no apparent capacity for homoeothermy—their temperatures rose when they were brooded and fell sharply when the parent left the nest. By May 16, when they were about 13 days old, the nestlings could maintain their temperatures well above that of the environment. As shown in figure 2, the nest temperature averaged 30°C. or above at this time, with only slight changes in accordance with environmental temperature. The older nestlings exhibited no tendency toward torpidity, which is consistent with Pearson's (1953) observations on young of other species of hummingbirds.

DISCUSSION

Kendeigh (1952:285) gives 16 to 17 days as the duration of incubation in the Trochilidae, and that of the Anna Hummingbird is given in Bent (1940) as 14 to 18 days. Several authors quoted by Bent express surprise that the incubation period in *Calypte anna* is as long as has been reported. As Nice (1953) states, "a firm conviction has existed that little birds must have short incubation periods" and that "humming-

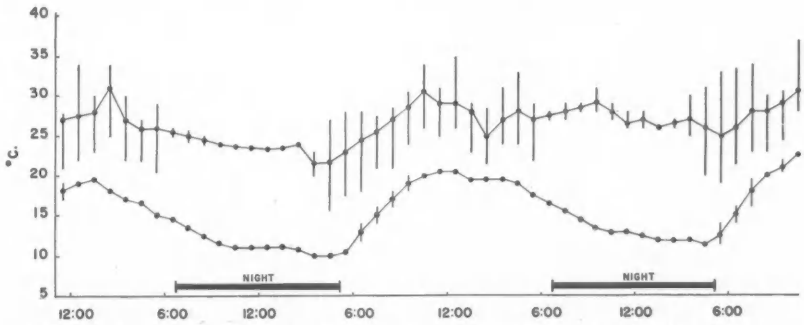

Fig. 1. Nest temperatures (upper) and air temperatures (lower) from April 29 to May 1, 1952, before eggs hatched. Points indicate approximate average temperature during each hour; vertical lines indicate extent of variation, if any, in temperature during each hour.

birds must have even shorter periods." We therefore paid close attention to the possibility that the "slow" development within the egg might be caused by low incubation temperatures at night as a result of the parent becoming torpid. As mentioned previously, however, we found no evidence of torpidity in the parent bird.

The data given by Kendeigh (1952:table 51) show that members of several families of small passerines exhibit incubation periods as long or longer than those reported for trochilids—e.g., the Pipridae (19-21), Troglodytidae (14-19), Regulidae (14-17), and the Parulidae (11-17). On the other hand, some families of larger passerines have shorter incubation periods than some of the smaller forms—e.g., the Mimidae (12-13), Turdidae (12-14), and the Alaudidae (11-12). In the absence of a consistent correlation between body size and length of incubation period in altricial birds, the duration of hummingbird incubation is not surprising.

The House Wren, *Troglodytes aëdon,* weighing between 9 and 10 gms., is the next smallest bird for which incubation temperatures over long periods of time are available (Baldwin and Kendeigh, 1932). These temperatures average about 37°C., which is several degrees higher than those which we obtained from the Anna Hummingbird. This discrepancy may be in part due to differences in technique, for Baldwin and Ken-

deigh placed the thermocouple inside the egg so that it was in contact with the embryo. Our figures for average nest temperature are undoubtedly somewhat lower than the true incubation temperature, for the thermocouple was at the outer surface of the eggs. However, even when the parent bird presumably came in contact with the thermocouple, the highest temperature recorded was 37°C., and it appears likely that the true incubation temperature of the Anna Hummingbird is slightly lower than that of the House Wren.

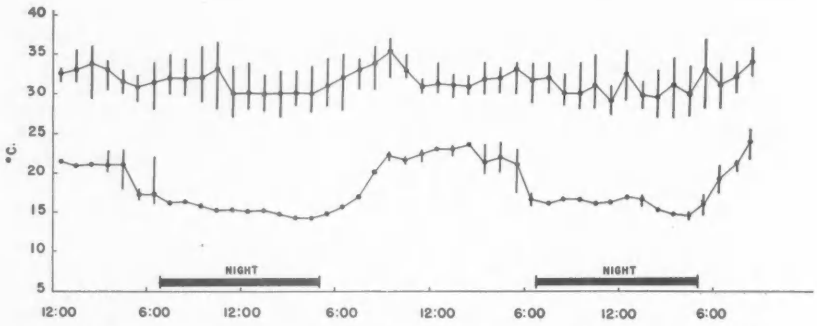

Fig. 2. Nest temperatures (upper) and air temperatures (lower) from May 16 to May 18, 1952, when young were 13 to 15 days old. Points indicate approximate average temperature during each hour; vertical lines indicate extent of variation, if any, in temperature during each hour.

The apparent absence of torpidity in incubating female hummingbirds is of interest from the standpoint of bioenergetics. Several factors may possibly enable the birds to maintain body temperatures and consequently nest temperatures above the environmental level at night when they are unable to procure food. Perhaps, as Pearson (1953) has suggested, intensive feeding before roosting might permit hummingbirds to sustain their rapid rates of energy metabolism through the night. However, with one exception (the evening of May 2, 1952), the records for this hour during six consecutive evenings fail to reveal that the nesting female studied by us spent unusually long periods away from the nest. Although on May 2 it was away for 20 minutes, presumably feeding, the average duration of its absences from the nest in the last active hour of the afternoon on the other five days was only 8.0 minutes (range: 2.9 to 10.6), which was often exceeded during the middle of the day. The presence of "feeders" nearby and the profusion of flowering plants in the immediate vicinity of the nest may have made these brief periods adequate. However, this female usually went away from the nest area to feed.

It is possible that the females of this species have a lower rate of energy metabolism than the males. Pearson found that the resting rate at 24°C. for the one male *Calypte anna* he studied was 13.9 cc. O_2/gm./hr., whereas that at 24°C. for the one female available was 10.7 cc. O_2/gm./hr. The reverse was true in two individuals of *Selasphorus sasin,* however, and additional data might also give a reverse picture in *Calypte anna.*

Another alternative is that the incubating female, which spends most of the day sitting quietly on the nest, may have more energy reserves than non-incubating individuals as a result of reduced activity. The energy stores thus conserved might permit the incubating female to maintain a relatively rapid metabolic rate overnight.

Food intake may be elevated in incubating individuals, but our data on inattentive

periods do not indicate that this is likely. If it does occur it could provide the parent with the energy reserves necessary to maintain a warm nest at night.

If any of the above factors are operative in allowing the female Anna Hummingbird to maintain a relatively high rate of heat production at night, they most certainly work in combination with the protection afforded to the adult bird by the nest. Hummingbird nests are tightly constructed and provide effective insulation for the ventral surface of the body. Since this is the surface from which the greatest amount of heat loss probably occurs, because of the position of the viscera and the large pectoral muscles, the insulation provided by the nest must function importantly in retarding heat loss from the incubating individual.

SUMMARY

Essentially continuous records of temperatures inside the nest of an Anna Hummingbird and of air temperatures nearby were obtained during several stages of the development of the young. Periods of inattentiveness by the parent female were usually less than 20 minutes and never more than 40 minutes in duration. This bird did not become torpid at any time while incubating the eggs or brooding the young. The nest was generally maintained about 10°C. warmer than the surrounding air. In the first few days after hatching, the young exhibited little capacity for homeothermy. However, they maintained their temperatures well above that of the environment at all times 13 days after hatching. *Calypte anna* is compared as to incubation period with members of various passerine families, and the means by which incubating female hummingbirds might avoid torpidity at night are discussed.

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NOTES ON THE NESTING OF THE THICK-BILLED EUPHONIA IN THE PANAMA CANAL ZONE

By GLADYS CARGILL BARNARD

Euphonias (*Tanagra*) are small, brightly colored tanagers with short bills and tails. The males are usually a dark, steel-blue above with bright yellow coloration on the forehead, forecrown and under parts. The extent of the yellow varies in the different species, of which four are recorded in the Canal Zone. The Thick-billed Euphonia (*T. laniirostris*) has a heavier bill than the others and differs further in having entirely yellow under parts, including the throat. The female is a yellowish olive green above and a clearer yellow below.

This species is known to range through much of tropical South America north to Costa Rica. In Panama, it is often found at the edge of jungle. The natives call it "pico-gordo," which means "thick-bill." The birds which are frequently captured and caged apparently survive on fruits, although wild euphonias are believed to feed chiefly on various species of tropical mistletoe.

Apparently the only published data on the actual breeding of the Thick-billed Euphonia are contained in a brief note by Carriker from Santa Marta, Colombia (Todd and Carriker, Ann. Carnegie Mus., 14, 1922:497); he describes the appearance of eggs and nest, which he indicates are usually placed in a crevice on the side of an overgrown earth bank. Wyatt (Ibis, 13, 1871:324), also in Colombia, reports seeing on March 7 a pair of these euphonias apparently looking for a nest site in the thatch of a shed.

This species has been found breeding regularly in the small town of Pedro Miguel, which is situated beside the Pacific locks of that name, on the eastern bank of the Panama Canal. The continental divide is only two and a half miles distant at Gold Hill, which overlooks historic Culebra or Gaillard Cut. Many low hills, some grass-covered and some jungle-clad, bring various forms of wildlife to the very edge of the landscaped areas about the residences. A narrow river and small lake, on the south and east, provides additional favored habitat, but it was not until we had moved from the lakeside to a cottage near the foot of Cerro Luisa that we saw our first pair of wild euphonias. They were in a small tree near our garage.

NEST SITE 1

In that same year, 1938, my neighbor, Mrs. Lawrence Adler, showed me a nest in a fern pot on the porch rail near her kitchen door. She said that a pair of tiny, black(?) and yellow birds had nested in it twice that season. The domed structure was hidden among the leaves, and it was of the type that I have since come to recognize as belonging to the Thick-billed Euphonia.

NEST SITE 2

On August 13, 1952, another neighbor, Mr. Adrian Bouche, who lived in the same vicinity, showed me a similar nest in a pot of ferns which were hanging close beside his front door. It contained two white eggs with brown spots or streaks.

NEST SITE 3

On January 18, 1953, a pair of Thick-billed Euphonias was seen pulling at the air-roots of an orchid (*Catasetum viridiflavum*) which grows in a tall mango tree near my house. Their presence here was further noted on January 21, 24, and February 11. On April 6, my neighbor, Mrs. Katherine Krause, told me that a pair had returned to nest among the stems of another orchid plant which grew in a wire basket suspended about

six feet from the ground beneath a large tree in her garden. The male of this pair was in immature plumage, which was golden olive above, with blue showing indistinctly on the back but forming a dark mask on the sides of the head; both the forecrown and under parts were yellow with a slight olive tinge on the chest and sides. Todd and Carriker (*op. cit.*) have previously suggested that immature males may breed.

On April 30, birds that appeared to be the same pair were plucking again at the *Catasetum* near my door, and Mrs. Krause told me that they were repairing the nest in the orchid basket, from which the previous brood had flown earlier in the month. On May 29 this new brood was well grown, and I went to sketch their nest. When a young girl appeared from a nearby house to watch, the parent birds chattered nervously in a low branch. Suddenly one of the young birds emerged, flew about fifteen feet across the yard and then returned to thick foliage near us. A few minutes later a second fledgling, and then a third, repeated this performance. The girl said that I, while sketching, missed seeing the fourth.

On July 9 this nest was pointed out to Mr. Eugene Eisenmann, who discovered that it contained one egg. The immature male and the female sat near by on a lime-tree branch, chipping excitedly. In July I was away for some time and on returning found that the top of the nest had been torn away, so I assumed that it had been abandoned. On July 25 at 7:30 a.m., I inserted my finger in the nest and was surprised when two euphonias flew out and away. There were no eggs in the nest at that time.

On August 4 two male euphonias were seen on bare branches of a poinciana tree at my house (50 yards from nest site). One fluttered and begged for food after the fashion of a young bird. The other spurned it and flew away. The next day a flock of six was seen among the mistletoe vines on a dying avocado uphill from our cottage.

On August 19 at about 8:30 a.m. the nest at the Krauses was found to have been repaired. The arched dome had been rebuilt to greater thickness than before. There was one egg inside. In the light of a flashlight this appeared to be white or pale pinkish-white and thickly streaked at the larger end with dusky brown. On August 20 at 7:30 a.m. there were two eggs in the euphonias' nest. Next day, August 21, at 7:40 a.m. and again at 4:30 p.m. there were three, and on the 22nd at 8:30 a.m. there were four, which completed the clutch. On August 28 I waited almost a half-hour to identify the nesting pair. When they appeared, together, at 10:45 a.m., it was possible to see that the immature plumage of the male was beginning to show a darker "V" on the upper back. The female entered the nest.

Although she was driven from the eggs by an inadvertent wetting with a garden hose on August 31, she was still sitting on September 4 at 9:20 a.m. I found the eggs unbroken when she left the nest. Returning at 11:15 a.m. on the same day, I found there were small birds in the deep pouch of the nest and at least one unhatched egg. It was impossible to be sure of the exact number of young without unduly disturbing the parents, which were sitting in the tree above me, scolding. The female, for the first and only time, was repeatedly uttering sweet, whistling notes, *phweee-oó-ee*. Thus, the incubation period was approximately 13½ days.

On September 20 I noted the adults to be absent for at least twenty minutes. At 11 a.m. they returned and watched me a few moments before the male flew to the nest and fed the young by reaching up into the entrance from his perch on an orchid bulb. The female did the same, and then they quickly flew away up the hill. Mr. Kenneth Edwards of Pedro Miguel says that he often watched the pair of Thick-billed Euphonias mentioned below feeding insects to their young. By this time the male was turning much bluer, although his wings and nape were still olive. By September 21 it was possible to count four young heads near the top of the nest cavity. They were there on the after-

noon of the 24th but had gone by 10 a.m., September 25. The nestling period was between 20 and 21 days.

NEST SITE 4

Nesting roughly contemporaneous with that of the Krause site occurred at the home of Mr. Edwards, about 650 yards distant, near the river. On April 19, 1953, he showed me a domed structure with side entrance and tiny overhang; it had been well hidden among the bulbs in an orchid pot, suspended about five feet from the ground. A board had been placed above the pot to protect it from rain water dripping from the porch floor. Mr. Edwards told me that the nesting of the previous year in the same pot had begun about the start of the rainy season in May and that two broods, of four and five young, respectively, had been raised there. At the time of my visit, on April 19, the nest contained four eggs. The male of this pair was in full adult plumage. Mr. Edwards later informed me that this brood left the nest safely in June. There were four young of a second brood when I next saw the same nest on July 9, 1953. They left the nest in the week of July 17.

This time the roof of the nest was not torn open at their emergence, as usually occurs, so we thought it a good opportunity to obtain a photograph. On July 31 we moved the orchid pot to the sidewalk for better lighting. We later learned that the nest had then contained three eggs, its third clutch of the season. Fortunately the birds did not desert, for on August 3 the nest held four eggs, all of which hatched. (There was no check between July 31 and August 3.) Mr. Edwards informed me that the first egg hatched on August 15. On the evening of August 16 there were three nestlings and one egg, and by the morning of August 17, the fourth egg had hatched. This incubation period could be reckoned only approximately (between 14 and 16 days). Mrs. Edwards reported that the young were still in the nest on the afternoon of September 3 but had all gone by 9:30 a.m. the next day. Hence the nestling period was 18 to 20 days.

Skutch's published data on two related euphonias (Auk, 62, 1945:25) are as follows: For *Tanagra lauta* in Guatemala he reports an incubation period of 16 days (a clutch of five), and a nestling period of 17 days for three young which had been handled. For *Tanagra luteicapilla* in Costa Rica he reports an incubation period of 13 or 14 days (a clutch of three), and nestling periods of 24 days (one young) and 22 days (two young).

Mr. Edwards has observed that the male Thick-billed Euphonia participates in the building and repairing of the nest but that the materials which he inserts in the structure are removed and rewoven by the female. Strips of dried heliconia or banana leaves are used to reline the bottom with each nesting. When the third brood left the Edwards nest, the roof was torn open; similarly, a torn roof (the cause undetermined) followed the third breeding attempt in the Krause nest. However, it was not broken for (or by) either the second brood at the former site, or the brood of the fourth attempt at the latter site.

ACKNOWLEDGEMENTS

I am much indebted to the neighbors named above for their cooperation in furnishing information for this paper, and especially to Mr. Eugene Eisenmann who lent encouragement, quoted references to previous publications, and assisted in the preparation of this paper.

SUMMARY

1. The Thick-billed Euphonia, a bird of the jungle edge, has nested near houses in Pedro Miguel, Canal Zone, for several years.

2. Nests have been found among the roots of ferns or orchids in hanging pots and baskets.

3. The nest is domed with a deeply down-curving entrance on the side under a small overhang.

4. The clutch seems usually to be four; one brood of five young has been reported.

5. Nesting has been observed from late March through August.

6. The incubation period was determined in one nest as between 13 and 14 days. In another nest the incubation period was determined only approximately—between 14 and 16 days.

7. The nestling period in one nest was between 20 and 21 days. In another nest, closer to a house and hence more subject to disturbance, it was between 18 and 20 days.

8. An instance is given of three successive and successful broods in the same nest, in one season, and apparently by the same pair of birds. In a nest of another pair, there was an apparently abortive attempt (involving the laying of at least one egg) between the second and third successful broods.

9. The same nest site has been used in two successive years.

10. Males breed while still in immature plumage.

Pedro Miguel, Canal Zone, October 9, 1953.

FROM FIELD AND STUDY

Electrocution of Parakeets at Agra, India.—While stationed at the Agra Army Air Force Base, United Provinces, India, from August to December, 1945, I observed an interesting cause of mortality among the common Rose-ringed Parakeets (*Psittacula krameri*). The Army had strung a large number of electric wires at the Air Base on which the parakeets were in the habit of perching, especially around the poles. The parakeets, with their habit of using their bills to assist themselves in climbing about amidst perches, often short-circuited themselves across the wires and thus were electrocuted. The accompanying photograph, taken on October 23, 1945, clearly shows two dead parakeets. One is clinging by a foot to a wire and the other is clinging by its beak. Two living parakeets. This scene was repeated at almost every electric pole on the base with anywhere from one to a half dozen dead parakeets clinging to the wires or lying on the ground beneath.

Many other species of birds such as Green Bee-eaters (*Merops orientalis*), Ring Doves (*Streptopelia decaocto*), and Magpie Robins (*Copsychus saularis*) also habitualy perched on these wires but were not killed because of their habits, which caused them to touch no more than one wire at a time.

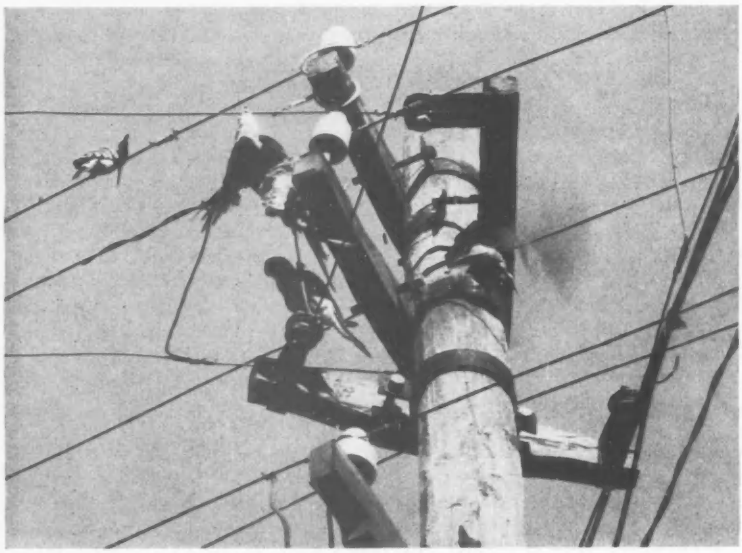

Fig. 1. Electrocuted Rose-ringed Parakeets.

After the breeding season, which is concentrated in March, these parakeets form immense flocks of many thousands of birds. These flocks descend upon standing fruit and grain and in some areas cause a tremendous loss of such crops. I have seen them almost covering millet, wheat, rice, and other grain fields. The same is true for fruit orchards. They also cause great damage to stored grain. I have seen stacks of grain bags piled on railroad sidings covered with these parakeets which were busily, and noisily, tearing open the bags with their strong bills to get at the grain within. They not only eat a great deal of such grain but by tearing the sacks open they cause much loss in transit. Since the food problem is such an acute one in India, it would be desirable if these depredations could be eliminated or at least reduced.

The foregoing observation on the electrocution of these birds may have some practical application for local control, despite the general feeling among the Indians against killing of any sort. Many

large fruit bats, *Pteropus,* were also killed by these electric wires. These bats also do considerable damage to fruit.

Since these parakeets, when they have formed flocks after the breeding season, have huge communal roosts, generally in a grove of large trees, they might be most easily controlled there. There was one such huge roost in a grove of large trees on the bank of the Jumuna River near the Taj Mahal at Agra. Parakeets roosted there by thousands. They generally arrived in parties of from a dozen to several hundred birds late in the evening during the last hour or so before sunset. At times the air would be filled with them and the din caused by their screaming and the thunder of their wings was indescribable.—WILLIAM C. DILGER, *Department of Conservation, Cornell University, Ithaca, New York, July 14, 1953.*

Another New Rail from the Pleistocene of Florida.—In a recent paper (Wilson Bull., 64, 1952:80) I described *Laterallus guti,* a new species of rail from Pleistocene deposits at Reddick, Florida. This species differed from its living representative (*Laterallus jamaicensis*) in larger size and more robust form.

At another Pleistocene locality, at Haile, Florida, Mr. Walter Auffenberg collected a complete humerus of a second undescribed rail, but one which is referable to the genus *Porzana.* This species differs from the living Sora Rail (*Porzana carolina*) and is described as

Porzana auffenbergi, new species

Type.—No. 742, collection of Pierce Brodkorb, complete left humerus; from Sangamon Stage of Pleistocene, in Stratum 2 (shell layer) near Haile, Alachua County, Florida, in Section 24, T. 9 S, R. 18 E; collected by Walter Auffenberg, April 17, 1953.

Characters.—Humerus agrees with *Porzana carolina* in proportions (see table 1), in well developed deltoid crest, distally produced entepicondyle, strong condyles, and stoutness. Differs from *P. carolina* in larger size, even better developed deltoid crest, and slightly more produced entepicondyle

Table 1

Measurements in Millimeters and Ratios of Humerus of Rails

Species	No. of specimens	Length	Proximal width	Width of shaft at center	Distal width	Proximal width to length	Shaft width to length	Distal width to length
Porzana auffenbergi (Middle Pleistocene)	1	39.0	7.8	2.6	5.6	20.0	6.7	14.7
Porzana carolina (Recent)	1	32.6–34.2	6.5–7.3	2.2–2.3	4.7–4.8	19.9–21.3	6.4–7.1	13.7–14.7
Porzana carolina (Pleistocene)	1, 2	33.7	7.2	2.3–2.4	4.8–5.0	21.3	6.8	14.8
Rallus limicola (Recent)	4	36.1–39.0	6.5–7.1	2.0–2.2	4.6–5.1	17.9–19.2	5.5–5.6	12.5–13.1
Rallus limicola (Pleistocene)	4	.....	....	2.0–2.2	4.5–4.7	.....	.....	.....
Rallus prenticei (Upper Pliocene)	1, 2	36.1	7.1	2.1–2.6	5.1–5.3	16.9	5.8	14.13

The humerus is about the same length as in the living Virginia Rail (*Rallus limicola*) but it is considerably stouter and accordingly the width-length ratios are higher. Furthermore it differs from *R. limicola* in the better developed deltoid crest, the more distally produced entepicondyle, and the stronger condyles.

Porzana auffenbergi differs from *Rallus prenticei* Wetmore (Univ. Kansas Sci. Bull., 30, 1944:99), of the Upper Pliocene of Kansas, in the greater length of the humerus, the stouter shaft, the heavier distal end, with the epicondylar prominences and trochleae better developed, and the more produced entepicondyle. It agrees with *R. prenticei* in the long deltoid crest.

Elsewhere (Wilson Bull., 65, 1953:49-50) I have described the stratigraphy of the deposit at

Haile and have listed seven species of birds from it. As far as could be determined from the fragmentary remains, those previously reported all seemed to represent species still living in the vicinity. The rails are especially well represented, since of the eight species of birds now known from Haile, four belong to the Rallidae. In addition to the avian remains there occur a few mammals, some fishes, and a rich herpetological fauna, mainly of aquatic forms. The herpetological material is being studied currently by Mr. Auffenberg.

Fig. 1. Left, humerus of *Porzana carolina* (no. 455, Pleistocene). Right, *Porzana auffenbergi* (no. 742, Pleistocene). × 1.

Fresh-water gastropods from the same stratum have been determined by William G. Fargo. They include: *Helisoma* near *disstoni* (Dall), *Helisoma* sp., *Succinea* sp., *Viviparus* sp., and *Ameria scalaris* Jay.

It might be thought that *Porzana auffenbergi* was the Pleistocene representative of the living Sora Rail. That such is not the case is shown by the presence in the Pleistocene of Reddick, Florida, of specimens indistinguishable from the living *Porzana carolina*. In figure 1 Miss Esther Coogle has drawn a fossil humerus of *P. carolina* for comparison with the type of *P. auffenbergi*. The living Virginia Rail (*Rallus limicola*) also occurs in the Reddick Pleistocene, and the measurements of both these species from Reddick are included in table 1. It is thus apparent that *P. auffenbergi* was not the temporal representative of *P. carolina*, nor of the living Neotropical *P. flaviventer*, which is even smaller than *carolina*. Rather it is an additional species of American *Porzana* whose phyletic line has become extinct.—PIERCE BRODKORB, *Department of Biology, University of Florida, Gainsville, Florida, June 10, 1953.*

Ground Dove Nesting at Anaheim, California.—A pair of Ground Doves (*Columbigallina passerina*) was observed from February, 1952, to March, 1953, by the writer and residents at Anaheim, California. The doves raised two young, one of which was killed when it collided with the window of a house. The bird was given to James Robinson of the Biology Department of the Whittier High School. The nest, found after the birds had left it, was about five feet from the ground in an orange tree. The habitat was an uncared-for orange grove at the edge of town adjacent to a wash containing willows, Baccharis and other natural plants. The birds were seen to feed upon chickweed seeds; mustard was also present and may have been a source of food. Food and water were also provided by residents in the neighborhood.

I know of no other record of this species nesting in coastal California, although Peyton (Condor, 50, 1948:165) reports two birds near Santa Paula on August 20, 1947. The environment at Anaheim was similar to that described by him, except that no cottonwoods were present.

During this same period I saw a pair of Ground Doves fly over the highway between Fullerton and Anaheim, and another individual was accurately described from an orange grove in another part of Anameim. Residents in the nesting area say they have seen as many as five birds, so it is possible there are other nesting pairs.—J. H. COMBY, *Whittier, California, March 11, 1953.*

Record of the Water-thrush in Oakland, California.—On September 6, 1953, while walking through Dimond Canyon, Oakland, California, I observed a Water-thrush (*Seiurus noveboracensis*) feeding along the edge of the creek. The bird seemed quite unconcerned until approached to within twenty feet. It then flew to a nearby Bay Tree. Only once, while in the tree, did it utter an alarm note. It returned to the ground almost immediately and continued feeding in the company of a Song Sparrow. After several minutes, it became rather nervous and flew into a thicket. I did not see the bird again, nor was it seen again on a subsequent visit.—KENNETH SCHULZ, *Oakland, California, September 11, 1953.*

A Census of Populations of the Wilson Snipe and Sora Rail in the Yampa River Valley, Colorado.—During the spring and summer of 1953, breeding populations of the Wilson Snipe (*Capella delicata*) and the Sora Rail (*Porzana carolina*) were censused by the writer in conjunction with a waterfowl production study in the Yampa River Valley of Colorado. The Yampa Valley is a long narrow floodplain and canyon extending from headwaters on the White River Plateau to its confluence with the Green River in northwest Colorado. The valley varies from one-fourth mile in width in the canyons to about 10 miles in width shortly after its emergence onto the floodplain proper just southeast of Steamboat Springs. The water table along the entire non-canyon portion of the valley is high, and development of sedge and cattail marsh is extensive. This habitat, plus the oxbow and meandering stream areas, constitutes the waterfowl, snipe, and rail breeding grounds found in the region. The principal snipe and rail breeding grounds are situated at altitudes ranging from 6000 to 8000 feet.

Wilson Snipe were most frequently seen around flooded meadows, bogs, and willow swamps, apparently preferring the boglike areas containing dense growths of sedge (*Carex* sp.). Sora Rails were invariably found in the vicinity of small marshy areas vegetated with cattails (*Typha*) and bulrushes (*Scirpus*).

Table 1

Territorial Snipe and Rails Observed on Study Areas

Area	Approximate elevation	Snipe		Rail
		Breeding territories	Winnowing areas	breeding territories
Stillwaters	9500	....	....	....
Phippsburg	7800	13	8	5
Steamboat Springs	6800	10	6	1
Tow Creek	6600	....	....	....
Carey Ranch	6400	8	4	5
Big Bottoms	6100	....	....	....
Duffey Mountain	5800	....	....	....
Juniper Springs	5700	....	....	1
Maybell	5600	1	2	....
Lily Park	5400	....	....	....
Total		32	20	12

Snipe were first observed in the valley in mid-April, but the greatest influx of birds was recorded in the first week of May. The first rails were seen on May 18, with the peak flight occurring early in June.

Winnowing flights of snipe were observed during May, June and July, the peak of activity being in June. Those winnowing flights during the early mornings were recorded in conjunction with waterfowl brood-counts. Territorial snipe and rails listed in table 1 were flushed as the observer walked through the study areas in search of waterfowl. Snipe or rails seen repeatedly in particular locations were recorded as territorial birds.

A snipe nest was found on June 5, and considerable numbers of young birds were seen during the breeding season. In August and early September snipe from individual breeding areas assembled in flocks of 20 to 60 birds in preparation for the fall migration.

Breeding populations of 20 snipe and 12 rails (table 1) were observed on the 10 study areas which constituted a randomized 10 per cent sample of the Yampa River Valley. Projection of these figures indicates total breeding populations of 200 snipe and 120 rails in the valley.—HAL M. BOEKER, *Colorado Cooperative Wildlife Research Unit, Colorado Agriculture and Mechanics College, Fort Collins, Colorado, September 9, 1953.*

Notes on the Nesting of the Kestrel in Japan.—On April 12, 1952, through the courtesy of Mr. Keisuke Kobayashi of Kobe and Mr. Yoshishiro Hosono of Nakano, Mr. Tokuzo Kojima and I were granted the privilege of visiting the only known nesting site in Japan of the Kestrel (*Falco tinnunculus japonensis*). Since very little information has been recorded, either in Japanese or English, on the nesting of this species in Japan, I take this opportunity to present the data obtained from observations made by Mr. Hosono, and personal observations made at the nesting site by Mr. Kojima and myself.

A previous nesting record for Japan of this species is listed in the Catalogue of the Collection of Birds' Eggs in the British Museum (vol. 2, 1902:310) by Eugene W. Oates, as follows: "4 eggs, Yokohama, Japan (H. Pryer) Seebohm Collection." Seebohm, in his Birds of the Japanese Empire (1890: 195), referring, apparently, to this same set, says "Eggs in the Pryer collection resemble those of the common form."

Mr. Kobayashi has in his personal collection three skins of nestlings taken on June 3, 1934, in Yamagata Prefecture, Honshu. According to him the collector is unknown, although advice gained from a friend of the collector indicated that the specimens were taken from a nest situated in a tree.

Kenji Shimomura of Tokyo is credited with having found a nest containing six eggs on April 9, 1942; it was located in an old nesting hole of the Pied Kingfisher (*Ceryle lugubris*) excavated in clay cliffs along a river valley near Kyoboku-mura, Ina-gun, Nagano Prefecture, Honshu. The entrance of the nesting hole measured 15 centimeters in diameter and the hole was approximately 100 centimeters in depth.

These earlier breeding records, as far as I am aware, are the only ones that exist for Japan.

The nesting site which we visited on April 12, 1952, consists of a series of natural cavities and ledges worn in steep, conglomerate cliffs, locally referred to as Ju-san-gake (Thirteen Cliffs), along the Yamese River, approximately one mile northwest of Shinano-mura, Shimotakai-gun, Nagano Prefecture, on the main island of Honshu at an elevation of 1575 feet. The cliffs extend along the river for approximately one mile and average approximately 85 feet in height with a maximum height of 110 feet. Their summit supports a fairly heavy growth of small and medium-sized deciduous trees and vines, which in places overhang the vertical faces and appear to provide temporary perching spots for the Kestrels. The cliffs in some places rise directly from the water's edge, whereas at other points they are located approximately 1000 feet distant, dependent upon the course of the stream within its broad bed. In many places the base of the cliffs is concealed by fairly large talus slopes, sparsely covered by small deciduous trees and brush, and extending up the sides of the vertical face of the cliffs to a height of approximately 50 feet. The face of the cliffs is composed of a very loose conglomerate which breaks away easily upon pressure of any sort. Rope climbing is, therefore, impracticable and all examination of nesting cavities was confined to those that could be reached with the aid of improvised extension ladders.

The Yamase River is a fairly small, shallow stream, which meanders through a wide, gravelly bed and occupies the center of a broad valley; the valley in turn is enclosed in the distance by lesser ranges of the North Japanese Alps. The valley is devoted principally to agriculture and consists of large, open, cultivated fields interspersed with small groves of pine trees and weed fields.

Nesting cavities and ledges within reach and examined, as well as those located at inaccessible heights, were well marked in most instances with deposits of white excrement directly below the cavity or ledge. The majority were clustered within approximately a half-mile stretch of the highest and most central portion of the cliffs and ranged from twelve feet above the top of the basal talus slopes to within a few feet below the vegetation overhanging the summits. A total of nearly 50 such excre-

ment-whitened sites was counted along the entire length of the cliffs at the time of our visit. According to information provided by Mr. Hosono, based upon a more detailed study of forty of these nesting sites, they range from 10½ to 29 meters above the base of the cliff and from 1 to 95 meters apart either horizontally or vertically; the total height of the cliffs at the nesting sites ranges from 10 to 29½ meters. At the time of our visit, certain ledges, located at unattainable heights and from 6 to 10 feet in length, were whitened along their entire reach; this may have been caused by nestlings moving along the ledges after they had gained sufficient strength to walk about.

We personally examined three nesting cavities at close range and found them to be from 42 to 56 centimeters in width at the entrance, 23 to 46 centimeters in height, and extending horizontally into the cliff from 122 to 200 centimeters. Hosono states that cavities he examined ranged from 30 to 50 centimeters in diameter at the entrance and extended into the cliff from 50 to 100 centimeters. All three cavities examined converged to much smaller proportions at the extreme end.

The three nests examined contained eggs in sets of five, seven, and eight, respectively. The sets of five and seven all proved to be in a fresh condition with no traces of blood; however, the set of eight consisted of five eggs partly developed, two badly discolored and infertile, and a single fresh egg. Since this appears to be an unusually large number of eggs in a single set, and since three different stages of egg condition existed, it is assumed that there was communal utilization of this nest. All eggs rested in a shallow depression directly on the dry, dusty, sandy floor of the cavity and were surrounded by small rocks approximately fist-size. No other nesting material was noted.

Measurements of 20 eggs examined ranged from 31.70 to 33.50 millimeters in width and from 37.45 to 42.00 in length; they averaged 32.70 × 39.97. Hosono took a set of five eggs on April 8, 1950, and two sets of five and six eggs each on April 13, 1950; the two latter sets were slightly developed and averaged 31.82 × 38.05 millimeters.

Hosono states that a total of approximately 60 to 70 adult Kestrels generally frequent the nesting cliffs and adjacent area during the breeding season. At the time of our visit, I estimated a total of about 40 adults in the immediate vicinity.

From the opposite side of the river and before we neared the cliffs, I studied the area through field glasses and observed considerable activity among the Kestrels as they went to and from the nesting holes, ledges, and perches in the trees. Others were observed singly in flight high over the river and surrounding countryside as they went either to or from the nesting cliffs. One was also observed approximately 1000 feet east of the nesting site as it flew up from a brush-covered talus slope with a small snake, 12 to 14 inches long, dangling from its talons. It flew to the top of a small leafless tree near the summit of the cliff, rested for a few moments, proceeded on to another tree nearby, rested again, and continued on in this manner until it had disappeared from sight over the top of the cliffs. Although the snake continued to writhe quite violently the whole time, the Kestrel made no attempt to kill it with its bill.

Additional information was gained on feeding habits of the Kestrel when feathers of the Japanese Wagtail (*Motacilla grandis*) and the Meadow Bunting (*Emberiza cioides*) were found in one of the three nesting holes examined. Fresh remains of a small mole were found in one of the other nests. Hosono reports, also, having found remains of the Meadow Bunting and moles along with cast pellets of mouse and mole remains along the bases of the cliffs on April 16 and 23, 1950. He also claims to have observed, from time to time, several adult Kestrels carrying what appeared to be lizards to the nesting site, and on April 13, 1950, he found a dead rat in the nest from which he took five eggs.

As we approached the bases of the cliffs and climbed the ladders to examine the nests, the majority of the Kestrels left the cavities and ledges, flew high overhead, perched in the tops of trees on the summit of the cliff, or left the area altogether. Now and then, single individuals flew within approximately 100 feet of us or perched reasonably nearby in small, scattered trees clinging to the face of the cliff. However, at no time did they attempt to swoop at or attack us nor did they ever utter a single note of alarm or protest while we were in the area.

A single Kestrel was observed, apparently brooding, on a narrow ledge approximately two-thirds of the way up the face of the cliff; it had its tail braced up against the cliff side and its head pointing outwardly. It remained in this position for some 45 minutes.—CHESTER M. FENNELL, *Yokohama, Japan, July 30, 1953.*

Unusual Records from California.—The following specimen records, considered of unusual interest, were obtained in San Luis Obispo County, California, in 1951 and 1952.

Sayornis phoebe. Eastern Phoebe. An adult male was collected in a grove of small cottonwoods on the Sacramento Ranch near Shandon on December 3, 1952. This is believed to be the third specimen taken in the state of California.

Empidonax difficilis. Western Flycatcher. As this flycatcher is regarded as a summer visitant only, it is of interest to report that one was taken by Mr. Eben McMillan at Cholame on November 24, 1951. The specimen, now in my collection, is an immature female. It has been identified by A. R. Phillips as *E. d. hellmayri*.

Ammospiza caudacuta. Sharp-tailed Sparrow. At Morro Bay, on December 27, 1952, I flushed five Sharp-tailed Sparrows from a salicornia flat. All flew directly to the thick vegetation, chiefly three-square bulrush, that fringes one side of this open flat, and I collected two of them near the edge of this cover. Both are females in fresh fall plumage and are similar to specimens of *A. c. nelsoni* from Beaver Hill Lake, Alberta, when consideration is given to seasonal plumage wear in the latter.

Melospiza georgiana. Swamp Sparrow. Mr. Eben McMillan collected a specimen of this sparrow for me in a three-square bulrush marsh near the southern extremity of Morro Bay on December 31, 1952. No others were seen in the numerous times the marsh was visited in the course of the winter. The specimen, a female in first-winter plumage, is darker and more blackish on the crown than is an immature male in comparable plumage from Nulki Lake, British Columbia, and in this respect more closely resembles a male in fresh autumn plumage from southern Ontario, which is an example of *M. g. georgiana*. One of the three other California-taken specimens is reported to display the characteristics of *M. g. ericrypta*, the two others being assumed to represent this "western" race (Pac. Coast Avif. No. 27:542). However, as Godfrey (Auk, 1949, 66:35-38) has demonstrated *ericrypta* is a northern, rather than a western race.—J. A. Munro, *Okanagan Landing, British Columbia, August 20, 1953*.

Further Notes on Plumages and Molts of Red Crossbills.—Jollie (Condor, 55, 1953:193-197) has recently made some assertions pertaining to Red Crossbills (*Loxia curvirostra*) that seem to me to require comment. He states (p. 193) that from the series of crossbills examined by him "it is clear that there are four typical plumages in the male (with rare variants): a striped, juvenal plumage, a mottled orange and yellow plumage (the first immature) which is later replaced by an adult-like red plumage (the second immature), and lastly an adult plumage characterized by reddish or brownish margined tail and wing feathers . . . ." He says also (p. 195) that the "plumages of the female Red Crossbill are much simpler. The juvenile molts into a typical female plumage soon after leaving the nest," the wing and tail feathers being retained until a "second molt." I presume this "second molt" corresponds to the first postnuptial molt in standard terminology of molts (Dwight, Ann. N.Y. Acad. Sci., 13, 1900:73-260, and most subsequent authors).

Jollie postulates that the two successive molts producing the "first and second immature" male plumages are completed before the skull entirely ossifies. The age at which ossification of the skull is complete in the Red Crossbill is not known. However, my impression, gained from collecting in the autumn, is that six months might be a fair guess for most species of passerines. Nero (Wilson Bull., 63, 1951:84-88), in a careful study of specimens of *Passer domesticus* of known age, determined that ossification of the cranium in this species was complete by ages 181 to 221 days—roughly six to seven months. If we assume that crossbills resemble other passerines in this respect, we must visualize, by Jollie's theory, two complete molts of the body plumage in about six months, followed almost immediately by still a third, prenuptial, molt which is incomplete (see Tordoff, Condor, 54, 1952:200-203). No other bird, to my knowledge, has a first-year sequence of molts of this sort. Jollie's conclusions were based on seven "first immature" and eight "second immature" males and seem to hinge on the occurrence of a few juvenal feathers on the belly in the first age class and their absence in the second age class.

As a speculative point, one might inquire as to the functional significance of a rapid-fire series of molts in young male Red Crossbills. In most birds, at least, the sequence of plumages and molts follows a pattern which seems to make sense biologically. That is, molts are not ordinarily "wasted." The resultant plumage usually serves some obvious function. No function is obvious to me for the two postjuvenal immature plumages—the first retained for only two or three months—presumed by Jollie to occur in male Red Crossbills.

A second point requiring comment is the supposed difference between the sexes in number of molts and plumages. Jollie states that, in their first year, males have one complete body molt more than females. This is difficult to believe, since the number of molts and plumages has not, to my knowledge, been found to differ between male and female in any other cardueline. The first winter plumage of female Red Crossbills is almost (or quite?) indistinguishable from the adult female plumage. How, then, is one to ascertain from study skins the number and sequence of molts and plumages with sufficient accuracy to warrant reaching the important biological conclusion that a marked sexual difference exists in the molts of this species? This might be solved through a study of living captive birds. In the absence of such a study, I regard the alleged sexual difference in molt as unproved.

The facts set forth by Jollie can, in my opinion, be explained best as follows: In *L. c. bendirei* and *L. c. sitkensis*, the juvenal plumage is followed by the first winter plumage, which in males is either red (="second immature") or a variable orangish-yellow (="first immature"), the latter phase perhaps tending to be more streaked on the belly. In *L. c. benti*, the orangish-yellow first winter plumage occurs in some populations (Baily, Denver Mus. Nat. Hist., Mus. Pictorial No. 9, 1953:35-37) but seems much less common or perhaps is lacking in others (Tordoff, *op. cit.*). The color of this first winter male plumage may be affected by diet. A partial prenuptial molt, which usually replaces red feathers with greenish feathers, results in the first nuptial plumage. Subsequent molts probably include only an annual postnuptial molt and an annual incomplete prenuptial molt, as in many other carduelines. Females probably have a similar molt sequence, even as immatures.—HARRISON B. TORDOFF, *Museum of Natural History, University of Kansas, Lawrence, Kansas, September 1, 1953.*

Incubation in the Chestnut-backed Chickadee.—In three of the past four years, Chestnut-backed Chickadees (*Parus rufescens*) have nested in a bird house in my yard in San Francisco, California. A hinged roof on the house has made frequent observations possible. Bent (U. S. Nat. Mus. Bull. 191, 1946:387) states that "The exact period of incubation does not seem to have been determined for this species. Dawson (1923) and Bowles (1909) both state that incubation begins when the first egg is laid, as the sizes of the embryos in a set of eggs vary considerably. Perhaps the bird does not incubate all through the laying period, but she covers the eggs when she leaves the nest, which keeps them warm . . . ."

In none of the three nests that I observed was incubation carried on at all until all the eggs had been laid. They were placed underneath the nesting material at the bottom of the bird house, but it is doubtful that this would have kept them very warm. At any rate, the eggs all hatched within about 15 hours of each other.

In the first of the three nests which I observed (1950, 7 eggs), incubation was begun on April 11. Three eggs had hatched by 8:00 a.m. on the morning of April 24. By 4:00 p.m., two more had hatched. The sixth egg hatched the following night. The seventh egg did not hatch. The incubation time in the nest, then, was 13 days for the first three eggs, and about 13½ days for the others.

In the next nest (1951, 6 eggs), incubation was begun on April 21, and the first eggs hatched during the night of May 3 or the morning of May 4. Five of the eggs had hatched by the evening of May 4. The sixth egg did not hatch. This, also, was 13 days for the first eggs to hatch, and about 13½ days for the rest.

The last egg was laid in the third nest (1953, 4 eggs) on April 15, and incubation was started then. The first egg hatched by 7:30 a.m. on April 29; two more hatched by 5:30 p.m. The fourth egg did not hatch. This is at least 14½ days for the first egg and 15 days for the other two. It is thought that the birds nesting this year were making their first attempt a nesting, as their actions were quite unlike those of birds nesting in previous years.—JOEL T. HEDGPETH, *San Francisco, California, September 3, 1953.*

Caspian Terns Nesting at San Diego Bay.—Observation of a nesting colony of Caspian Terns (*Hydroprogne caspia*) at the extreme south end of San Diego Bay, California, is reported herewith. A search of the literature has revealed no prior nesting record for this species in San Diego County, California, although such records have been published for the Salton Sea, in Imperial County, and for Scammon Lagoon, Baja California (Willett, Pac. Coast Avif. No. 21, 1933:79).

The present colony was noted by the writer and a group of observers from San Diego State College on May 18, 1953. Its appearance was strikingly similar to that described by Miller (Condor, 45,

1943:220) and De Groot (Condor, 33, 1931:188) at San Francisco Bay. Both the San Diego and the San Francisco colonies had located their nests on the flat tops of earthen dikes forming basins used by commercial salt works. Behavior of the birds at San Diego was almost identical with that noted by Miller and De Groot, as was nest construction, numbers of eggs, action of the newly-hatched birds, presence of small fish dropped by the parent birds near the nests, and the presence of small regurgitated pellets of fish scales.

A few differences, however, should be noted to add to the cumulative record of this bird in California. The San Francisco colony was concentrated along a dike that was much wider than that utilized by the birds at San Diego. Here, the nesting site was a dike averaging not more than four feet in width, so that the nests were staggered in rather uniform fashion along about 300 yards of the dike and in many places were placed practically on the edge of the dike. This no doubt accounted for the many dead young (approximately 30) which were found among the clods on the muddy beach at the base of the dike. In San Francisco a strong prevailing wind apparently accounted for numerous eggs found at the water's edge below the dike. This was not the case at San Diego. However, many of the nests—with eggs and young—were found on the beach itself, some of them placed as much as six feet from the base of the dike.

Another item of difference was an apparent gradient in the hatching time of the eggs within the colony at San Diego. Most of the nests at the south end of the dike still contained eggs at the time the observations were made. However, as the observers stepped carefully among the nests and proceeded northward through the colony, it was seen that the more northerly sets had hatched earlier. Finally, it was seen that there was a perfect series, ranging from the unhatched eggs, through a zone of nests containing eggs that were hatching at the time of the visit, and another group of nests where all eggs had hatched a few hours before the visitors appeared, and so on, up to the extreme northern end of the colony, where the birds were at least a week old and many were making their first attempt at swimming.

In addition to the bay smelt and shiner perch noted by Miller as common food for the young, the adults of the San Diego colony also provided black perch (*Embiotoca jacksoni*).

Unfortunately, circumstances prevented the taking of a census, and the writer can submit only a rough estimate of the population of the San Diego colony on May 18: approximately 100 nests and 250 adult birds. Many of the dead young examined had been banded.

During the three hours spent at the colony no evidence of predators was noted, with the exception of one California Gull (*Larus californicus*), which flew toward the colony and was driven off by a group of the adult terns.

Mr. Merrel A. Taylor guided the observers to the colony and reported that he had seen the same species nesting at the location in 1952.—D. L. Emblen, *San Diego, California, September 18, 1953.*

Copulation of Anna Hummingbirds.—On Sunday, August 30, 1953, at about 2:00 p.m., my husband and I were gardening at our home in the Montclair District, Oakland, Alameda County, California. Perched on the clothesline, singing, was a male Anna Hummingbird (*Calypte anna*). Each day for the previous ten days a male Anna Hummingbird had been perching in about the same place and singing, presumably the same male hummingbird. During the same ten days, a female Anna Hummingbird was frequently observed collecting tent caterpillar webs from our infested oak tree (*Quercus agrifolia*). The web gathering was resumed by the female this Sunday while the male continued his singing on the clothesline, twenty feet away. Suddenly the female flew from the oak tree and perched on another clothesline immediately over our heads. Instantly the male left his perch to hover over and then mount the female. During the few seconds of copulation the male's wings fluttered rapidly, while the female remained perched. Immediately after copulation, the female returned to the oak tree and the male to his perch on the clothesline. Although I did not note dates, there was courtship behavior by two Anna Hummingbirds in our yard just prior to August 30. After August 30, I occasionally saw the female in the oak tree and the male was on his usual perch and singing daily until September 27, when I noted that his song was shortened and not as frequent as on earlier dates. It was also during the period after August 30 that the male became very aggressive. For the first time in our garden an Anna Hummingbird succeeded in banishing an Allen Hummingbird. This he did fiercely and repeatedly.—Betty Trousdale, *Oakland, California, January 21, 1954.*

NOTES AND NEWS

We report with deep regret the death on November 2, 1953, of Walter K. Fisher, Honorary Member of the Cooper Ornithological Society and editor of the Condor from 1903 to 1905. His pioneer efforts in the early formation of the Cooper Club and of its journal were critical factors in the long sustained success of these undertakings.

Carl B. Koford's monograph on the California Condor has been selected by the Wildlife Society as the best publication of the year in the field of game and wildlife research.

COOPER SOCIETY MEETINGS

SOUTHERN DIVISION

NOVEMBER.—The monthly meeting of the Southern Division of the Cooper Ornithological Society was held on November 24, 1953, at the Los Angeles County Museum, Los Angeles. The following were proposed for membership: James Cowan Greenway, Jr., Box 26, Wellesley, Mass., by Letti H. Low; Mrs. Frank Christensen, 8037 Alvern St., Apt. C, Los Angeles 45, Calif., by Junea W. Kelly; S. Dillon Ripley, Peabody Museum, New Haven 11, Conn., by W. J. Sheffler; John Earl Taft, 160 Eugenia Dr., Ventura, Calif., by T. R. Howell; John George Williams, M.B. O.U., Coryndon Museum, P. O. Box 658, Nairobi, Kenya Colony, East Africa, by E. N. Harrison; Miss May Fluhmann, 180 Clarence St., Apt. 6, Ottawa, Ontario, Canada, Richard M. Freeman, Cortner Hall, University of Redlands, Redlands, Calif., Carolyn T. Murphy, 251 S. Norton Ave., Los Angeles 4, Calif., Cedric Thomas, 12196 Laurel Terrace Dr., No. Hollywood, Calif., Kunio Tsuneyoshi, 516 No. Virgil Ave., Los Angeles 4, Calif., and Robert William Wise, 5127 Briggs Ave., La Crescenta, Calif., all by J. C. von Bloeker, Jr.; John C. W. Bliese, Biology Dept., Nebraska State Teachers College, Kearney, Neb., Terrell Hunter Hamilton, Box 4174, College Station, Tex., Dr. William L. Lloyd, 3981 Menlo Ave., Los Angeles 37, Calif., Bruce Stark Lowney, 313 S. Beachwood Dr., Burbank, Calif., William Joseph Maher, 1831 E. 15th St., Brooklyn 29, N. Y., Douglas Scott Miller, 122 Lawrence Ave., East, Toronto, Ontario, Canada, Dr. Mildred Miskimen, Miami University, Oxford, Ohio, Robert David Ness, 17 Five Points Rd., Rush, N. Y., Marguerite M. Peugh, Apartado 16, Montemorelos, N. L., Mexico, Alfred E. Smalley, 608 N. Main St., Barbourville, Ky., Henry C. West, 5820 Crittendon Ave., Indianapolis 29, Ind., Miss Mary Elizabeth Whelan, 215 Catherine, Muskegon, Mich., and Hans E. Wolters, 28 Nikolaus-Becker-Str. (22-C), Geilenkirchen, bei Aachen Nordrhein-Westfalen, West Germany, all by C. V. Duff.

An invitation to participate in the coming meeting of the Pacific Division of the American Association for the Advancement of Science at Pullman, Washington, was read and upon motion duly made, seconded and carried, Dr. Thomas R. Howell was appointed chairman in charge of representation of the southern division.

J. R. Pemberton and Ed N. Harrison reported some of their experiences on their recent photographic trip to Kenya, East Africa.

Tom J. Cade of the University of California at Los Angeles spoke on "Birds of St. Lawrence Island, Bering Sea, Alaska."—R. L. TAYLOR, *Acting Secretary*.

JANUARY.—The monthly meeting of the Southern Division of the Cooper Ornithological Society was held on January 26, 1954, at the Los Angeles County Museum, Los Angeles. The following were proposed for membership: Mrs. Barbara Joan Arsenault, 708-C Pine, Santa Monica, Calif., by T. R. Howell; Mrs. Myrtle V. Dix, 509 Esgar Ave., Modesto, Calif., by Francis H. Boynton; Richard R. Graber, W.W.C. 552, Norman, Oklahoma, by A. H. Miller; Don R. Medina, 364 Roswell Ave., Long Beach, Calif., by M. Dale Arvey; Karl Plath, 110 S. Wesley Ave., Oak Park, Ill., by W. J. Sheffler; George Good Jones, 2930 East 3rd St., Tucson, Arizona, by Allan R. Phillips; Mrs. Kathleen G. Poulson, 1015 West Clinton, Fresno, Calif., by John G. Tyler; Walter Joseph Back, 7630 - 85 Dr., Woodhaven 21, N.Y., and Lester L. Short, Jr., 179 John Street, Ilion, N. Y., by C. G. Sibley; Mrs. Shirley J. Adams, P. O. Box 557, Hawthorne, Calif., Daniel D. Berger, 5026 N. Elkhart Ave., Milwaukee 11, Wis., Raymond A. Campbell, 686 4th Ave., Chula Vista, Calif., Mrs. Agnes Hawkins, Route 4,

Box 752, Phoenix, Ariz., Philip Kahl, 122 East 47th St., Indianapolis, Ind., Mary Orr, P. O. Box 183, Reserve, N. M., and Howard F. Young, Biology Dept., Western Illinois State College, Macomb, Ill., all by Jack von Bloeker, Jr.; Ronald L. Church, 122 Eleventh St., Pacific Grove, Calif., Miss Mary Ferguson Coble, 1357 No. Stanley Dr., Hollywood 46, Calif., John Hugh Dignam, 4 Kensington Ave., Willowdale, Ont., Norman F. Gaelick, 924 18th Ave., S.E., Calgary, Alberta, Tom V. Goodman, 732 South Mansfield Ave., Los Angeles 36, Calif., Albert Blaine Kloppenborg, 901 East 7th Street North, Newton, Iowa, Kenneth Krumm, Lacreek National Wildlife Refuge, Martin, So. Dak., Frederick P. Mangels, 708 Farmers Ave., Bellmore, L. I., N.Y., Charles William McRae, Rural Route 2, Austell, Ga., Burt L. Monroe, Jr., Ens., U.S.S. Badoeng Strait, % F.P.O., San Francisco, Calif., Mary H. Myers, Box 690, Mecca, Calif., Joseph Austin Nielsen, 253 Warren St., Brooklyn 2, N.Y., John M. Satter, 4500 Millersville Road, Indianapolis 5, Ind., Wilson C. Schramm, 321 Lensington Rd., Syracuse 10, N.Y., Robert D. Schweitzer, 1 Blackstone Pl., Riverdale 71, N.Y.C., N.Y., Winslow Morse Shaughnessy, 657 Forest Ave., Glen Ellyn, Ill., Anne W. Wachenfeld, 787 East Clarke Pl., Orange, N.J., Eugene J. Wilhelm, Jr., 4725 Lee Ave., St. Louis 15, Mo., Alice L. Williams, 542 Anderson Rd., Davis, Calif., and Harold B. Yeaton, 12908 Riverside Dr., Van Nuys, Calif., all by C. V. Duff.

Report of the Nominating Committee consisting of C. V. Duff, W. J. Sheffler and J. R. Pemberton, was given by C. V. Duff. The committee suggested the names of Jean Delacour for president; Thomas R. Howell for first vice-president; Vernon Barrett for second vice-president; and Dorothy E. Groner for secretary. There being no further nominations, it was moved by Jack C. von Bloeker, and duly seconded, that the nominations be closed and that the secretary be instructed to cast an unanimous ballot for the slate as proposed. Motion carried.

A motion was made by Kenneth L. Stager, seconded and duly carried that the Southern Division of the Cooper Ornithological Society go on record as urging that the Check-list Committee of the American Ornithologists' Union give due consideration to the elimination of common or vernacular names for subspecies in their forthcoming Check-list, as it is felt that common names for subspecies serve no real purpose and only cause confusion.

Bayard H. Brattstrom of the University of California at Los Angeles presented an illustrated account of "The Birds of the Revillagigedo Islands, Mexico," in which he described the gradual return of flora and fauna to an oceanic island recently devastated by an erupting volcano.—DOROTHY E. GRONER, *Secretary*.

NORTHERN DIVISION

DECEMBER.—The monthly meeting of the Northern Division was held on December 3, 1953, at the University of California, Berkeley.

President Orr appointed a Nominating Committee to prepare a slate of nominations for Northern Division officers to be presented at the January meeting. Members of the committee are: Mrs. Junea W. Kelly, chairman, Mr. Eric C. Kinsey, and Mr. Robert K. Selander.

Mr. Howard Cogswell reviewed Hahn's new textbook "The Biology of Birds" and President Orr called attention to N. Tinbergen's new book "The Herring Gull's World."

The speaker of the evening, Mr. Bert Harwell, showed his color motion picture, "Exploring for Sandhill Cranes."—ROBERT K. SELANDER, *Secretary*.

JANUARY.—The monthly meeting of the Northern Division was held on January 7, 1954, at the University of California, Berkeley. Dr. A. Starker Leopold, reporting as Chairman of the Natural Resources Committee, urged members of the Society to write to their congressmen and to the President of the United States opposing the construction of a dam in the Dinosaur National Monument.

Mrs. Junea W. Kelly, Chairman of the Nominating Committee, presented the following nominations for officers of the Northern Division: Dr. T. Eric Reynolds, President; Mr. Donald D. McLean, First Vice-president; Dr. A. Laurence Curl, Second Vice-president; and Mr. Robert K. Selander, Secretary. On motion by A. Starker Leopold, a unanimous vote was cast for this slate of officers.

The following field observations were reported: Mrs. Junea W. Kelly observed a pair of bushtits inspecting a potential nesting site on December 2; on December 11 the framework of the nest was well started.

The speaker of the evening, Robert K. Selander, reported on the "Distribution of Wrens and Jays in Chiapas, Mexico."—ROBERT K. SELANDER, *Secretary*.

Concerning Cooper Society Memberships and Subscriptions

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For Sale, Exchange, and Want Column—Each member of the Cooper Society is entitled to one short advertising notice in any issue of the Condor free. Notices of over 3 lines will be charged for at the rate of 25 cents per line. Send advertising copy to Jack C. von Bloeker, Jr.

Wanted—Bibliography of Birds, pt. 2, by Reuben M. Strong, Field Museum of Natural History. Please state price and condition.—William H. Adams, Jr., *2808 Calhoun St., New Orleans, La.*

For Sale—At $20.00 each, original (signed) pen and ink illustrations for Pettingill's two "Guides to Bird Finding" and my own "Mexican Birds—First Impressions," proceeds to be used for further field work in Mexico.—George Miksch Sutton, *Department of Zoology, University of Oklahoma, Norman, Oklahoma.*

Wanted—Audubon Field Notes, vol. 1, no. 6 (Feb. 1952) to complete our Museum Library set. —Kenneth C. Parkes, *Carnegie Museum, Pittsburgh 13, Penn.*

Wanted—2-inch by 2-inch slides of western birds. Please state price.—C. J. Parkes, *821 N. Garfield Ave., Alhambra, Calif.*

For Sale—Birds of Western Pennsylvania, by W. E. C. Todd (Univ. Penn. Press, 1940), 118 species illustrated in color, like new, with dust wrapper, out-of-print and very rare, $17.50; Foreign Finches in Captivity, by A. W. Butler (1899), 60 full page color plates, like new, a "must" for the aviarist, $25.00; Illustrations of the Birds of California, Texas, Oregon, British and Russian America, by John Cassin (1856), 50 color plates (issued as a suppiement to Audubon's Birds of America, but not duplicating Audubon's work), the first edition (not often seen these days!), bound in full leather, perfect condition, $100.00; all volumes sent prepaid when check accompanies order.—W. Lee Chambers, *R. R. 1, Box 294, Topanga, Calif.*

Wanted—The Condor, vol. 1, no. 3, and vols. 2, 3, 4 and 5.—George Miksch Sutton, *Department of Zoology, University of Oklahoma, Norman, Oklahoma.*

For Sale—Naturalists' Guide to the Americas, $10.00; Biological Investigations in Mexico, Goldman, $3.50; Mammals of New Mexico, Bailey, $10.00; Game Birds of Hawaii, Schwartz, $3.50. —H. H. T. Jackson, *National Museum, Washington 25, D. C.*

For Sale—List of Mexican Birds, by species, with scientific and common names and abbreviated notation of distribution, 25 pp., 1 map, 40¢ each, three for $1.00, postpaid.—Ernest P. Edwards, *Box 611, Amherst, Virginia.*

For Sale—The Oölogist, 1904 to 1907, nearly complete. Will exchange for needed issues of the Condor; write for complete want list.—Norman R. French, *Division of Biology, University of Utah, Salt Lake City, Utah.*

For Sale—Introduction to Ornithological Nomenclature, revised, 1954, by Mary Ferguson Coble, 96 pp., paper, $1.50 each (a dictionary of scientific names based on structure, color, markings, habitat, characteristics, food, geographic locations, and patronyms).—Helen S. Pratt, *2451 Ridgeview Ave., Los Angeles 41, Calif.*

For Sale—The "Tiny Tucker" Hummingbird Feeder, complete with instructions for use, $1.00 plus 15¢ postage; all profits realized to be used for maintenance of the Tucker Bird Sanctuary.—Arnold Lane, *Box 53, Star Route, Modjeska Canyon, Orange, Calif.*

Binocular Information—See our article in January-February Audubon Magazine for a simplified method of checking alignment of a binocular. Read our "Know Your Binoculars" previously published in Audubon Magazine to learn how to choose the model best suited for your purpose and to obtain the most use from it; fully illustrated reprint 10¢ (no charge to members of Cooper Ornithological Society). If your binocular needs repair or coating, send it to us for free estimate; if a new one is needed, request our list of American, German, and Japanese glasses, all guaranteed adjusted to U. S. Government specifications and sent on 20 days' free trial; liberal trade-in allowance. We answer questions personally and also check glasses without charge. If you have a binocular problem, let us help you solve it.—The Reicherts, *Mirakel Repair Co., Mount Vernon 15, N. Y.*

LIFE HISTORIES OF CENTRAL AMERICAN BIRDS

FAMILIES FRINGILLIDAE, THRAUPIDAE, ICTERIDAE, PARULIDAE and COEREBIDAE

By ALEXANDER F. SKUTCH

The Cooper Ornithological Society announces the appearance of the Life Histories of Central American Birds as Pacific Coast Avifauna No. 31.

This volume contains life histories of 40 species of birds of Central America belonging to the higher families of song birds—the finches, tanagers, troupials, wood warblers, and honeycreepers. The accounts are the work of a skilled, sensitive and patient naturalist who has devoted a quarter of a century of outdoor work to the intensive study of the varied and complex bird life of the mountains and lowlands of Latin America. All but two of the accounts are heretofore unpublished and for each of the five families a summary and a comparison of the highlights of the breeding biology of the species are given.

Dr. Skutch, the author, was trained in botany at Johns Hopkins University. In 1928 he first visited the American tropics in Panama. There soon grew in him a determination to devote his life to learning all he could of the habits of the birds of Central America. Botanical jobs and finances were always adapted to the fullest possible pursuit of this goal in bird study. After work in Honduras and Guatemala, Dr. Skutch settled in Costa Rica in 1941 on his own farm in the wild and isolated section of El General. In support of this particular writing he received a fellowship from the Guggenheim Foundation, and in 1950 he was awarded the Brewster Medal of the American Ornithologists' Union for his publications on Central American birds.

The book consists of 448 pages, and it is illustrated by Don R. Eckelberry. A group of four tanagers is shown in color and all the other species are represented by line drawings. Thirty-two photographs show nests and habitats of tropical America.

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